Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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START

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A Note on the Sources

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 36

NOTEBOOK SERIES (NBK-14)

Menlo Park Notebooks, #95 - #113

Menlo Park Notebook #95 [N-80-00-03]

This notebook is undated but probably was used during 1880 and 1881. The entries appear to be by Charles L. Clarke. The book contains a record of technical and scientific books and their prices. It is subdivided into the following categories: electricity, steam engineering, treatises on general science, gas, general engineering, and mathematics. The first page is inscribed "Catalogue of Scientific Books." The book contains 284 numbered pages.

Blank pages not filmed: 10-33, 44-69, 78-117, 124-147, 156-175, 180-283.

No. 95

No 95

1

Catalogue of Scientific Books

10

2
2

500 .32

32) 500 (15
32
180
160

7

5

2 2

Electricity

Angell.
Elements of Magnetism and Electricity $0.75

Calland.
Essai ~~sur~~ les Piles. $1.00

Clark,
An Elementary Treatise on Electrical Measurement for the Use of Telegraph Inspectors and Operators. $2.00

Ferguson - Electricity $1.75.

Napier - Manual of Electro-metallurgy. $3.75

Guthrie.
Magnetism and Electricity. $1.50

Radau,
Le Magnetisme.
104 Wood Cuts. $1.00

Bos.
La Physique
$3.60

Day, Exercises in Electrical and Magnetic Measurement.
$1.25

Mascart.
Traité D'Electricité.
R
$12.10

Tyndall.
Lessons in Electricity at Royal Institution
$1.25

Cumming.
Theory of Electricity.
OK 1879 $3.00

Bottomley. OK
Electrometers. $0.50

Dolbear,
The Telephone, $0.75

Bell. The Telephone, $0.60

Niaudet.
Traité elementaire de la Pile Electrique. $2.40

Noad.
Text-Book of Electricity,
~~[illegible]~~ $4.50

Higgs.
Electrical Transmission
of Power. $1.20

Electric Lighting.
Report to House of
Commons. 1879. $2.00

Dub,
Der Elektromagnetismus
$3.70
Die Anwendung des Elektro-
Magnetismus mit besonderer
Berücksichtigung der neueren
Telegraphie. $7.70

Kohlrausch, F.
Leitfaden der praktischen
Physik mit einem Anhange.
Translation. OK $1.90

Steam Engineering.

10 at Gd

Bourne

A Treatise on the Steam Engine.

Van N. London $15.00

Complete treatise, considered one of the best.

Nystrom. $3.50
Pocket-Book of Mechanics
Contains full practical tables for the mechanical engineer and steam user

Trowbridge
Tables and Diagrams relating to Non-Condensing Engines and Boilers $2.50
Very good.

Jellet.

A Treatise on the Theory of Friction. $4.00

Box.

A Practical Treatise on Heat as applied to the Useful Arts. $4.25

Very good and practical.

Stewart - Balfour.

An Elementary Treatise on Heat. $2.50

Porter. The Richards' Steam Indicator.

The best book out. $3.50

Siemens,

Fuel 10.50

Gordon.

Elementary Book on Heat. $0.75

Irving. Short Manual of Heat for schools. $1.25

Spon.

The Present Practice of Sinking and Boring Wells, with Geological Considerations and Examples of Wells Executed, $3.00

Ireson's Horse Power Diagram. $4.25

Buell's
Safety Valves.
$0.50

McCulloch,
Mechanical Theory of Heat.
$3.50

Fell.
Notes on Using Steam Expansively.
$0.60

Nystrom,
A New Treatise on Steam Engineering, Physical Properties of Gases and of Different kinds of Vapor.
$2.50

Rowan,
On Boiler Incrustations.
$0.40

Stewart, Balfour.
Elementary Treatise on Heat.
$3.00

Rigg. A Practical Treatise on the Steam Engine.
$2.00

Burgh.
Pocket-Book on Compound Engines.
$3.75

Pochet.
Steam Injectors, their Theory and Use.
$0.50

Le Van,
Steam Boiler Engineering

Bramwell,
The Steam Engine.
$0.20

Poillon,
Cours théorique et practique de chaudières et de machines a vapeur.
$8.00

Boilers.
Deterioration of.
Parlimentary Report.
$5.50

Graham.
Elementary Treatise on Steam.
$3.50

Cotterell,
Steam Engine as a Heat-Engine.
$5.00

Hirn

Fourier,
Analytical Theory of Heat,
Translation, 1878.
$8.00

Baynes,
Lessons on Thermodynamics.
$2.75

Fuel, Clark, D. K.
Its Combustion and Economy,
$1.50

Treatises on General Science.

&c

Ganot's Natural Philosophy

Deschanel's Natural Philosophy

Jamin – Physics.

Weinhold –
Experimentale Physics, $15.75
Translated from the German

Noble – Useful Tables. $0.25.

Weale's
Engineers, Architects and Contractors' Tables. $3.00

Garnett, Elementary Dynamics for Schools and Colleges. $3.00

Walker,
Prime Cost of Keeping,
for Engineers, Iron Founders,
Boiler and Bridge Makers &c.
$3.50

Seyton's.
Pocket-Book for Boiler
Makers and Steam Users, $2.00

Unwin,
Tables of Logarithms,
English and Metric Measures &c.
$0.80

Arnott: Elements of Physics.
$3.00

Everett, Illustrations of
Centimetergramme. $2.00

Todhunter,
Natural Philosophy for
Beginners. Each $1.50

Everett. Elementary Physics.
$1.75

Lees,
Acoustics, ~~Light~~ and Heat.
$1.50

Pernolet,
L'Air Comprimé et ses
applications. $8.00

Putnam.
Metric System of Weights
and Measures. $1.00

Scribner's

Pocket-Books

Each $1.50.

Thomson & Tait.
Natural Philosophy.
$4.50

Chandler;

Petroleum as an Illuminator

$0.50

Giroud,

De la Pression du Gas d'Eclairage et des Moyens a employer pour la Regulariser. $3.60

Fodell,

~~A Practical Treatise on the Science and~~

A System for Keeping the Histories and Accounts of Gas Light Companies, with Forms &c usual for Such Companies $5.00

Matthews,
An Historical Sketch of Gas Lighting,
London 1827.

Accum.
Description of the Process of Manufacturing Coal Gas.
London 1818.
These books interesting to show gas lighting in its infancy.

Hughes,
Gas Works and Manufacturing Coal Gas.
$1.40

Richards,
A Practical Treatise on the Manufacture and Distribution of Gas.

Wilson,
Common Sense for Gas Users. $1.00

King's Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas.
Edited by T. Newbigging.
Vol. I now pub.
Recommended by Engineering as the best in English Language.

General

Engineering.

Reuleaux.
Kinematics of Machinery.
$7.50

Achard.
De la Transmission et de la Distribution des Forces Motrices a grand distance. $3.00

Stahl. Transmission of Power by Wire Ropes. $0.50

Clark. A Manual of Rules, Tables and Data for Mechanical Engineers. $7.50
The best.

Howard.
Hydraulic Presses and other Hydraulic Machinery.
$1.25

Box.
On Mill Gearing, Wheels, Shafts, Riggers &c. $3.00

Haupt.
A Manual of Engineering Specifications and Contracts.
$3.00

Zahner.
Transmission of Power by Compressed Air.
$0.50

Thurston, Prof. R. H.
Friction and Lubrication. Determination of the Laws and Coefficients of Friction by New Methods and with New Apparatus. $1.50

Ledoux. M.
Ice Making Machines.
$0.50

Ingenieur's Taschenbuch
$2.65

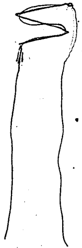
Weisbach.
Lehrbuch der Ingenieur- und Machinen-Mechanik.
$20.00

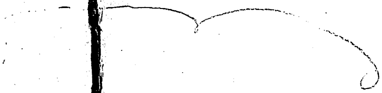
Der Ingenieur.
Very good. $2.10

Spon's Dictionary of Civil, Mechanical, Military, and Naval Engineering. With ~~technical~~ terms in French, German, Italian, and Spanish. $40.00.

Mathematics

Chambers
Mathematical Tables.
Logarithms 1 to 108 000.
$1.75





Menlo Park Notebook #96 [N-79-09-20]

This notebook covers the period September-December 1879, with a few entries possibly dating from 1880. All of the entries are by Samuel D. Mott. Included are drawings of lamps, generators, vacuum pumps, and other devices such as the phonograph and the telephone. There are occasionally notes accompanying the drawings, some of which were used as illustrations in the Scientific American. The label on the front cover is marked "Private" and "S. D. Mott." The first page is inscribed "Edison's Inventions Notes & c." Both the cover and the first page are stamped "Edison Pioneers 40 West 40th Street New York City." The book contains 284 numbered pages.

Blank pages not filmed: 53-284.

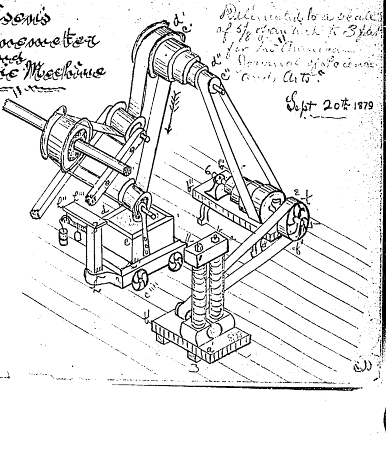
Missing page numbers: 9-10.

Edison's Inventions Notes &c.

EDISON PIONEERS
ROOM 1102
40 WEST 40TH STREET
NEW YORK CITY

Edison's Dynamometer and Faradic Machine

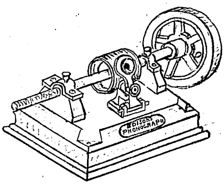
a	b	7"
a'	b'	28½"
a"	b"	3' 1"
f"	f"'	20"
e	d	18½"
e'	d'	8"
e"	d"	4"
e	c"'	22"
ε	f	5"
f	f'	22"
g	h	4' 1"
h	h'	8"
g	h"	24"
h"	h"'	5"
a	3	5'
a	1	21½"
3	4	31"
5	6	3' 8"
c"'	a"'	7"



Delineated to a scale of 5/8 of an inch to 3 feet for the "American Journal of Science and Arts"

Sept 20th 1879

Sept. 25th 1879.
S. D. Mott. del.



Edison's Pride.

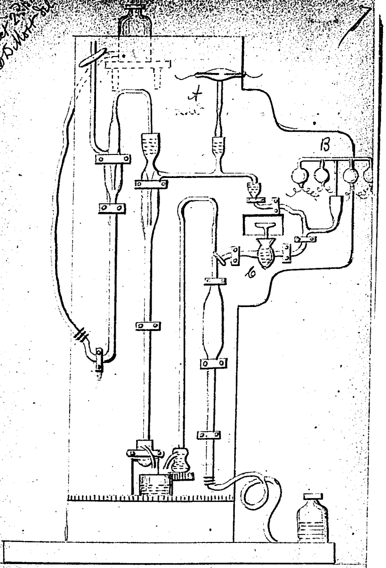
9 Edison's combination of the Geissler and Sprengle fall tube pumps to obtain high vacua.

A - Electrical test of vacuum

B - Electric lamps

C - Mercury seals

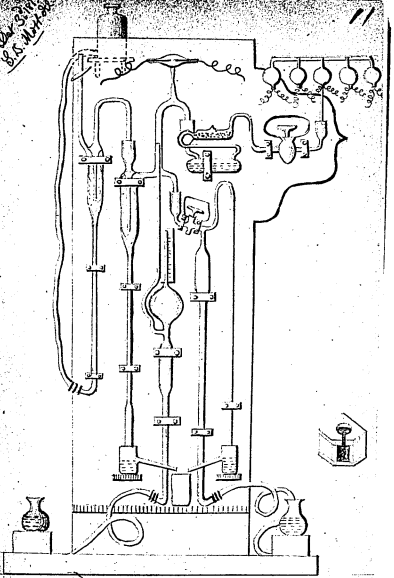
Oct 23/79
S D Mott Del.



7

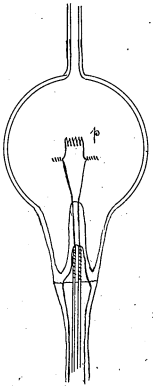
The same combination in connection with the Maclod gauge — and chambers of Sulphuric Acid (to take up moisture) and granulated Copper (to take up ammonical fumes)

Oct 3 1879
S.D. Mott



12

B

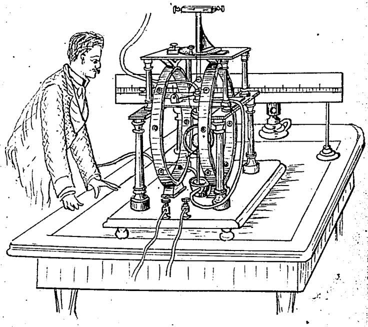


p - a platina spiral in vacuo —

Edison's Lamp as it is at present

— Oct. 1879. —

Illustrated in Scientific American of Oct 1879.

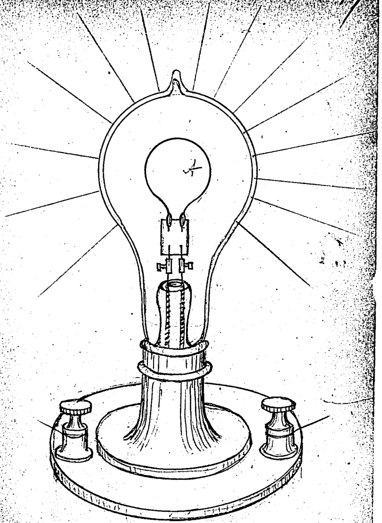


ELECTRO DYNAMOMETER.

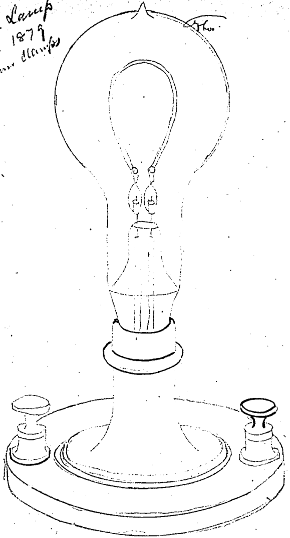
Lamp as it appears this date (Nov 1879)

A loop of Clarks 3 - 3 [illegible] thread rolled in [illegible] and [illegible] then carbonized at a white heat [illegible] = 3 gas jets — adapted for 1 gas

[illegible] — [illegible] paper [illegible] good [illegible] also fine [illegible] (visiting card)



Paper Lamp
Dec 1879
Platinum clamps



Illustrated in the Scientific American of
Oct 1879.

23

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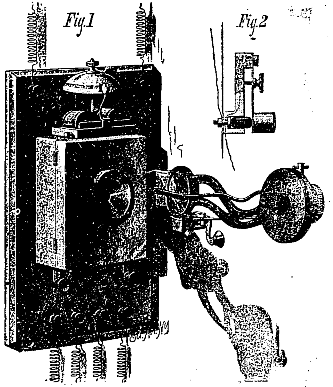
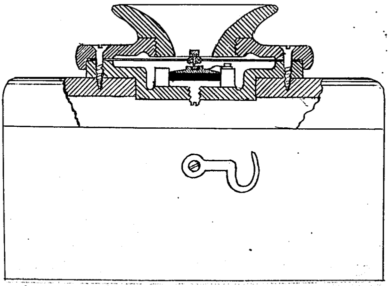
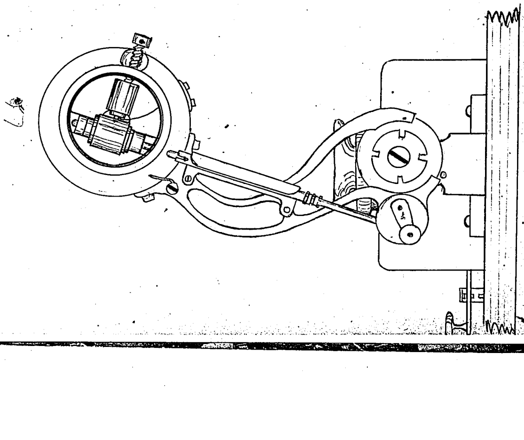


EDISON'S NEW TELEPHONE.

Delineation in Cross section by myself for Mr Edison
Oct 15. 1879. Full Size tracing

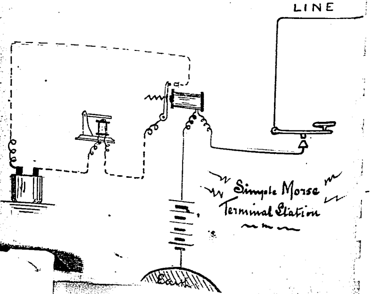


Delineated by myself for Mr Edison Oct 20th 1879.
One-half full size tracing.—

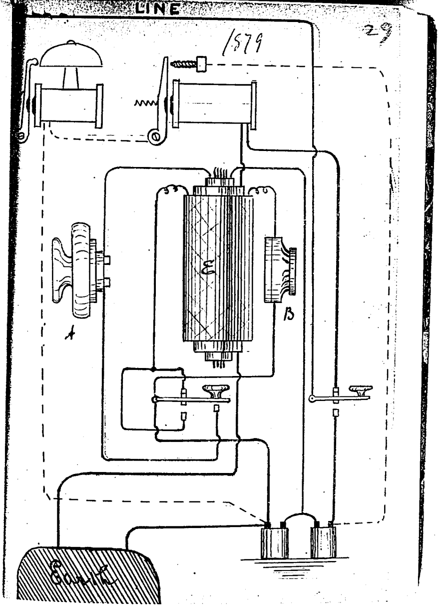


Deliniated to show the currents Connections & practical working of Edison's Telephone.

E Induction Coil
Primary Circuit
Secondary "
Tertiary "
A Transmitter
B Receiver.
Relay Circuit in Outlet lines



1879



Deliniated to show the currents Connections & practical working of Edison's Telephone.

E — Induction Coil

—— Primary circuit

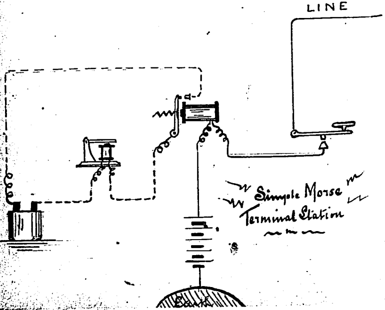
▬▬ Secondary "

═══ tertiary "

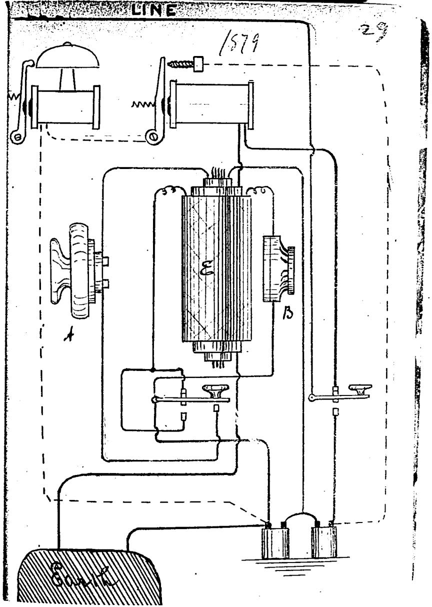
A Transmitter

B Receiver.

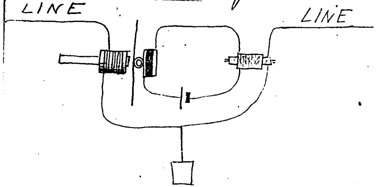
Relay Circuit in dotted lines



1879



Telephone Relay

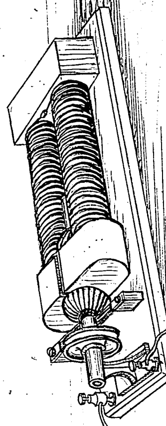


 Distribution of Energy in Electromotors —

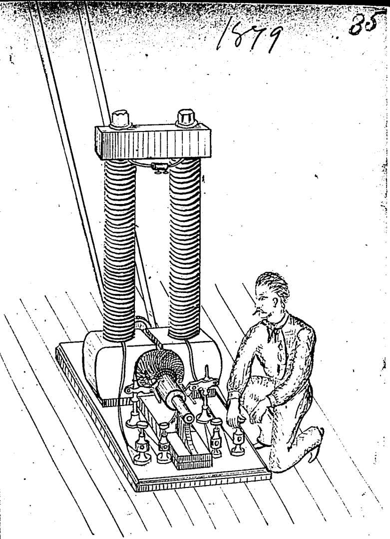
Any receiving motor no matter what its resistance may be would if there were no friction run at the same speed as the transmitter, but as there is always friction it will run at a lower speed which speed will be such that it will set up a counter E.M.F. a little less than the transmitter the difference will exactly represent the work. If more work is attempted to be taken from the receiver there will be a lessening of the counter E.M.F., this lessening will represent the work — for instance, if it only have the friction of the machine the counter E.M.F. will be, say 98, 2 representing the work in friction If we take of 3987 ft lbs of work inclusive of friction with 10 ohms resistance in the circuit, the counter E.M.F. will be 90 volts to 100 volts in the transmitter.

We think that in any electromotor that the power will be within reasonable limits independent of the size of the magnets composing such motor with a given current — if the magnets are small in mass the speed will be great, if large in mass the speed will be slower, but the power will be greater to ballance the loss by want of speed, but with the large magnets is given more current and consequently have the advantage. The power obtainable is probably as the square of the size of the motor magnets — double the size and you can by increasing the current obtain 4 times the ft lbs with the same economy per 1000 ft lbs as in the smaller motor

1879.



EDISON'S ELECTRIC MOTOR.



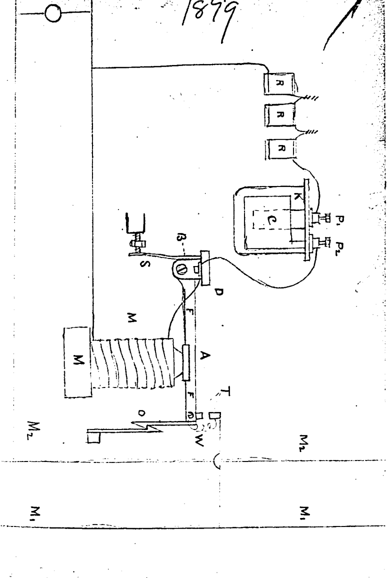
EDISON'S ELECTRIC GENERATOR.

1879

The Meter

its action

Points T are supposed closed, Current enters from Main Line M through binding post E_2 and passes through the points T by means of the bar F through through the hinge B to the binding nut D. — The Current at this point divides the larger portion of it passing around the Magnet M and directly out at the post E_1 and by means of the line H_1 to the lamp — the remaining portion at the point of division D passes through the Cell and Resistance connecting to H_1 at E. All of it then passes through one or more translating devices such as lamp motors &c to the line H_2 and the ~~Man~~ return main M_2. In passing around the magnet M it tends ~~to make~~ render it ~~more~~ active so as to draw down the armature A, this tendency for the weak current is counteracted by the adjustable spring S — if the current by any means is abnormally great it will make the magnet so strong as to attract the armature A ~~and~~ pull downwards the arm F, separating the points T and breaking the circuit.

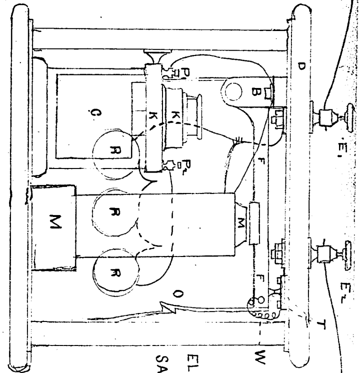


 The Clutch O will then Close as is represented in the diagram page 37 — The cover W serves to Short Circuit the arc which would otherwise spring between the points T when the Current has broken and also to prevent the armature with the break Circuit from acting as a Vibrator.

From the binding nut D a small portion of the current passes through the deposition cell K which is so Constructed that every unit of Current passing will deposit an amount of Copper proportional to the Current flowing on the plate of copper.

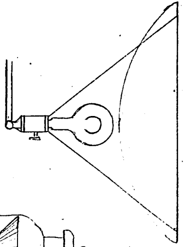
Resistances RRR are placed in the line so that the amount which flows through the deposition cell may be adjusted until a fixed fractional part of the main current is used. It is proposed to place a thin and exactly weighed plate into the meter at the commencement of a fixed period & at the end of that time to take it out & carry it to the central office where it will be exactly weighed — the difference in weight is the amount deposited. A certain number of milligrams ~~of Copper~~ may be assumed to equal to a foot of gas, by taking an Electric light of a given intensity say 16 candles and allow it to burn for a few hours noting the deposition of copper at the same time a gas flame of equal intensity is burned and the number of Cubic feet consumed noted — the resistances will then be adjusted until 1 Mg for example will represent 1 Cu ft —

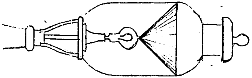
Bills will then for Electric light ~~will then~~ be made out in terms of 1000 cu ft — Parts M_1M_2 main lines in street — H_1H_2 House lines of wire — L lamps points at which the current may be broken. W ~~small~~ wire A armature. O clutch M magnet B hinge S sp P_1P_2 binding posts C copper plate R resistance coils D binder nut F.F. binder posts F Bar to which the armature A is atta

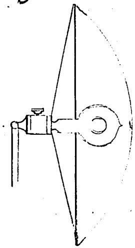


EDISON'S ELECTRIC METER AND SAFETY CLUTCH COMBINED.

In a paper read by Mr C.E. Jones of Chesterfield England before the association of Gas Managers, May 1879 — was said; "The chief requirements of public lights 1 Steadiness of flame not susceptable of atmospheric commotions 2 Uniformity of Intensity 3. great penetrating power 4 Ever available without preparation and Easily lighted 5 non liability of any sudden or self extinguishment 6 Shaddoless 7 Commercially Cheap"—







Laws relating to
Edison Electric lighting System

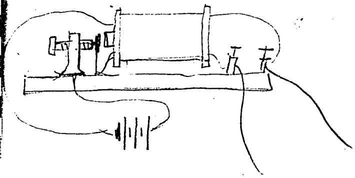
When the energy is doubled on a given ra-
diating surface the light is quadrupled

With a given radiating surface, and a given
energy, doubling the surface reduces the light
1/2 so that each of the two parts will have
but 1/4 of the light that it originally had =
Quadrupling the surface requires double the
energy to produce the same light.

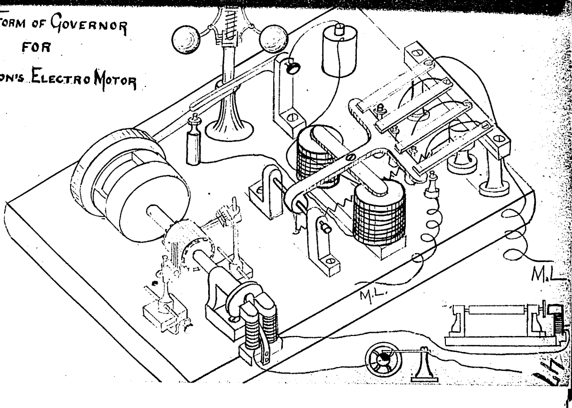
The resistance of any lamp in multiple arc
is the square of the total resistance of all the
lamps in series, the radiating surface being
the same.

If any machine will keep 5 lamps of a
given radiating surface and 1 ohm each
resistance at 15 candle power when arranged
in series then the same machine will
keep 5 lamps of the same radiating surface
of 25 ohms each in multiple arc at 15
candle power

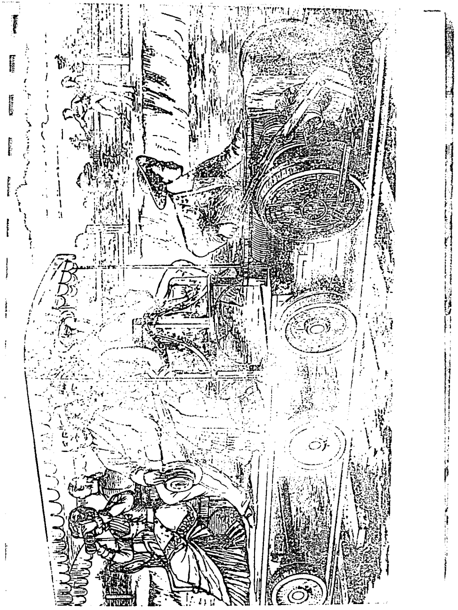
The cost of conductors and machine
resistances are the same for 10 one ohm
lamps in series as 10 - 100 ohm lamps in
multiple arc = the resistance of multiple
arc lamps must be 100 times greater than
those in series to produce same results
providing 10 are in one circuit.



ONE FORM OF GOVERNOR
FOR
EDISON'S ELECTRO MOTOR



48



The Chief improvements that have taken place for the last few years, in Dynamo Electric Machines are based upon — 1st The principle of accumulation. 2d Continuous Magnetization — In the Weston machine the principle of accumulation is employed — this machine with a Siemens Armature 3½ in diameter and 18 in effective length will deposit 28 oz of Silver per hour when driven at a speed of about 2000 rev per minute by means of a 2 Horse P. Steam Engine

This = permanent magnets
the = Electro magnets

The general principle of all dynamo Electric machines – The rotation within the influence of the poles of a magnet, of a Soft-iron armature surrounded by one or more helices, an electrical current being produced in the helices by the rapid magnetization & demagnetization of the Soft iron armature —

Menlo Park Notebook #100 [N-81-04-12]

This notebook covers the period April-July 1880. It is a continuation of Menlo Park Notebook #25. All of the entries are by John W. Lawson and consist of notes and tables relating to meter experiments. A set of calculations relating to these experiments was also found in the book. These loose sheets have not been filmed. The label on the front cover is marked "Meter Experiments." There are 284 numbered pages. Pages 20-39 contain skeleton tables that were never filled in. They have not been filmed.

Blank pages not filmed: 1-3, 54-284.

No.	[illegible]	Weight	Difference	Date	Time
1	456	15·5875	·161	April 12	4·50 P.M.
2	"	14·0000	·1616	"	"
3	"	18·9915	·1646	"	"
4	"	14·4032	·1454	"	"
5	"	8·0646	·0991	"	"
6	"	7·9075	·1028	"	"
7	"	8·338	·107	"	"
8	"	4·1812	·0711	"	"
9	"	4·1496	·0699	"	"
10	"	4·0505	·0673	"	"
11	"	4·0876	·0647	"	"
12	"	8·4419	·1076	"	"
13	"	8·474	·1055	"	"
14	"	9·5969	·1108	"	"
15	"	9·7677	·1078	"	"
16	"	4·9265	·050	"	"
17	"	4·5265	·0545	"	"
18	"	4·470	·046	"	"
19	"	5·1243	·0529	"	6·20 "
20	00	11·428		13	12.M.
21	"	15·0042			
22	"	15·7535			
23	"	11·8112			
24	"	6·5432			

18 19 removed from solution. 16, 17, 18 & 19 Thoroughly oxidized. The others all clean.

20 – 27, New plates washed in HNO_3 and placed in the solutions to remain there until signs of oxidation appear.

20 – 23 electrolytic copper.

24 – 27 hard rolled copper.

The solutions had been acting on plates previously & the putting in of these

For solutions 20 – 23 see Bk. 25 pg 264

" " 24 – 27 pg 270

28, in 250 c.c. $Cu(NH_4)_2(SO_4)_2$ sp. gr. 1.15 at 75° F.

~~To each solution was added 2 c.c. H_2SO_4~~

No.	[illegible] solution	Weights	Difference	Date	Time
25	00	6.5292		April 13	12.25 P.M.
26	"	6.5096		"	
27	"	6.4414		"	12.35 "
28	"	9.8182		"	6. P.M.
29	"	10.3449		"	" "
20	336	11.3302	.0978	27	12. M.
21	"	14.908	.0962	"	" "
22	"	15.656	.0975	"	" "
23	"	17.7137	.0975	"	" "
30	00	32.6205		30	2. P.M.
31	"	28.215		"	
32	"	26.888		"	
33	"	22.4643		"	
34	"	23.6502		"	
35	"	25.6375		"	
36	"	25.029		"	
37	"	19.6205		"	
38	"	15.6108		"	
39	"	16.6565		"	
40	"	13.0065		"	
41	"	12.020		"	
42	"	8.925		"	3 "

Signs of oxidation 20-23 see pp. 4 and 5 — also Pl. 26 pp. 264, 266, 268, 270, and 272

29 in 250 c.c. $CuSO_4$ sp. gr. 1.217 at 75° F. To each solution was added 2 c.c. H_2SO_4 conc. The plates to remain in solution until signs of oxidation ~~begin~~ appear.

Plates 20-23 - Length of time 534 hours taken to saturate the 250 c.c. solution having a copper surface of 8 sq. in. presented to it. Whole average amt. of Cu taken up by the solution .1727 grm.

Plates 30-45 in solution 15 pts. solution $CuSO_4$ sp. gr. 1.13 at 75° F

1 pt. H_2SO_4 conc.

Surface of plates exposed to action of solution

No 30 = 16 sq. in.
" 45 = 1 " "
each in the series varying from the other by one square inch.

No.	hours in solution	Weight	Difference	Date	Time	
43	∞	6.330		Apr 30	3:05 P.m.	24–27 see pgs. 4, 5, 6, 8 and 9 also Bk 25– pg 270 and 272
44	"	4.600		"		
45	"	2.782	"	"	3:15 P.m.	
25	668	6.353	.1762	May 11	8: AM.	
24	741	6.3727	.1705	14	9 "	
26	"	6.3798	.1898	"	" "	
27	"	6.2583	.1831	"	" "	
30	431	32.369	.2515	18	3. P.m.	
31	"	27.9816	.2335	"		
32	"	26.668	.220	"		
33	"	22.2565	.2078	"		
34	"	23.4313	.2189	"		
35	"	25.4328	.2047	"		
36	"	24.827	.202	"		
37	"	19.4405	.180	"		
38	"	15.4265	.1843	"		
39	"	16.497	.1595	"		
40	"	12.858	.1485	"		
41	"	11.8835	.1365	"		
42	"	8.798	.127	"		
43	"	6.221	.109	"		
44	"	4.511	.089	"		
45	"	2.7125	.0695	"	4:15 P.m.	

Plates 24–27, oxidized
amt. of Cu taken up by solution
from 24 = .196 grm. 26 = .209 grm.
25 = .196 " 27 = .202 "

Plates 30–45.

These results not to be relied upon for the reason that the areas upon the plates at the point of contact between the solution and air had been attacked to a greater extent than the other portions of the plates

30–45 see pgs 6, 7 and 8

No.	hours in solution	Weight	Difference	Date	Time
56	00	31.538		May 20	10.30 A.M.
57	"	27.119		"	
58	"	25.774		"	
59	"	21.406		"	
60	"	22.553		"	
61	"	23.634		"	
62	"	24.036		"	
63	"	18.543		"	
64	"	14.821		"	
65	"	16.103		"	
66	"	11.862		"	
67	"	11.518		"	
68	"	8.312		"	
69	"	5.927		"	
70	"	4.126		"	
71	"	1.748		"	11.45 A.M.
56	264	31.407	.131	June 1	10.30 A.M.
57	"	27.003	.116	"	
58	"	25.662	.112	"	
59	"	21.300	.106	"	
60	"	22.439	.114	"	
61	"	23.470	.164	"	
62	"	23.884	.152	"	

Plates 56–71 Same plates that were used in experiments 30–45. The arms were cut off so that there was no portion of the plates that was not covered with the solution, new solution same as in experiments 30–45—

Plates 56–71.

The discrepancies shown here in the losses from the plates is probably due to the vesicular structure of the copper, some plates exposing a proportionately greater surface to the action of the

No.	Amount solution	Weight	Difference	Volts	Time	
63	264	18.456	.087	1.		66–76 see page 10 and 11
64	"	14.684	.137	"		
65	"	15.971	.132	"		
66	"	11.800	.062	"		
67	"	11.467	.051	"		
68	"	8.275	.037	"		
69	"	5.886	.041	"		
70	"	4.102	.023	"		
71	"	1.728	.020			
72	500	37.575		"	11.45 AM.	
73	"	10.773		4	1. PM.	
74	"	34.5455		"		
75	"	21.8808		"		
76	"	21.091		"		
77	"	10.8105		"	1.25 "	
78	"	35.649		"	8.30 "	
"	"	18.167		"	" "	
79	"	125.940				
80	"	125.390		6	2. "	
81	"	22.6937		"	" "	
82	"	~~22.45~~88		7	8. AM.	
				"	" "	

solution than others

Plates 72–77
Standard solution used
1 H_2SO_4 & 15 $CuSO_4$ sol.
surface of plates exposed to action of solution –

72 = 12 sq. in.
73 = 3 " "
74 = 12 " "
75 = 6 " "
76 = 6 " "
77 = 3 " "

72 and 73 in 500 c.c. solution
74 and 75 in 250 c.c. "
76 and 77 " 175 c.c. " "
electrolytic copper, free from vesicularity used –

plates 78 –
2 plates in 500 c.c. sol.
both in one bottle
sq. surface of one = 12
" " " other = 6

Plates 79 and 80 made of wire

No.	hours in solution	Weight	Difference	Date	Time	
72	81	37·4605	·0445	June 7	10. P.M.	72–77 see pps 12 and 13
73	"	10·7365	·0367	"		
74	"	34·4975	·048	"		
75	"	21·853	·0278	"		
76	"	21·0642	·0268	"		
77	"	10·7892	·0213	"	10.25	
72	00	37·4652		"	11. P.M.	
73	"	10·7433		"		
74	"	34·501		"		
75	"	21·8585		"		
76	"	21·0682		"		
77	"	10·7892		"	11.25 "	
78	73·5	35·6055	·0435	"	10 A.M.	see pps. 12 and 13
78	"	18·1455	·0215	"	" "	
83	00	39·460				
83	"	11·235		11	3 P.M.	
84	"	39·3275		"		
84	"	11·322		"		
85	"	38·422		"		
85	"	11·1505		"		
86	"	39·658		"		
86	"	10·865		"		

·13 in. dia. The wire was made into a coil and placed 450 c.c. standard solution each coil exposing a surface of 8 sq. in.

Plates 81 and 82 made from electrolytic copper each placed in 450 c.c. standard solution and exposing a surface of 8 sq. in. each.

Plates 83–92.

Standard solution used 10 vessels used, 2 plates in a vessel each vessel containing 525 c.c. sol.

~~No. of~~ Sq. in. of plates in the vessels, –

Vessel	sq. in. of plates
83	16 and 4
84	16 and 4

No	hours in solution	Weight	Difference	Date	Time
87	00	42·245		June 11	
"	"	32·754		"	
88	"	41·741		"	
"	"	24·399		"	
89	"	41·5545		"	
"	"	18·088		"	
90	"	31·335		"	
"	"	17·4365		"	
91	"	31·2135		"	
"	"	7·6595		"	
92	"	30·725		"	
"	"	25·465		"	
83	475	39·245	·215	July 1	10 AM.
"	"	11·160	·075	"	
84	"	39·071	·2565	"	
"	"	11·241	·081	"	
85	"	38·188	·234	"	
"	"	11·075	·0755	"	
86	"	39·438	·220	"	
"	"	10·791	·074	"	
87	"	42·033	·212	"	
"	"	32·5945	·1595	"	

Vessel	sq. in. of plates
85	16 and 4
86	" " "
87	16 and 12
88	16 and 8
89	16 and 6
90	12 and 6
91	12 and 2
92	12 and 8

No	heavy solution	Weight	Difference	Date	Time
88	475	41.5215	.2195	July 11	
"	"	24.284	.115	"	
89	"	41.315	.2395	"	
"	"	17.960	.128	"	
90	"	31.108	.227	"	
"	"	17.310	.1265	"	
91	"	30.9655	.248	"	
"	"	7.597	.0625	"	
92	"	30.512	.213	"	
"	"	25.315	.150	"	
79	610	125.401	.539	2	10 A.M.
80	"	124.858	.532	"	"
81	592	22.418	.2757	"	"
82	"	22.147	.3118	"	"
28	1944	Perfectly clean today		3	
29	"			"	

83–92 see pgs 14, 15 and 16

79–82 see pgs. 12, 13 and 15

28–29 see pgs. 5, 6 and 7

Refer to Bk. 25.

Plates 1 to 6, to note the action of solution ~~of~~ on copper -
see pages 238, 240, 242, 244, 246, 248, 250, 252 -
4 and 5 stop on page 244
6 stops on " 242
5 and 6 not on page 240

plates 7 to 15, to ascertain if the action of solution on copper is influenced by form of plate
see pages 240, 242, 244, 246, 248, 250, 252 -
10 to 15 not on page 244.
7 to 9 remarks on page 241 -

plates a to h, to ascertain the relation between surface quantity of solution and loss, and to obtain data for constant loss -

see pages 242, 244, 246, 248, 250, 252 –

9 stops on page 250 –

A new series of experiments commence ~~of~~ on page 254 –

Plates 1 to 24, to ascertain difference of loss from equal surfaces in unequal quantities of solution, unequal surfaces in equal quantities of solution and also to note how the loss is influenced by the structure of the copper –

plates 1 to 18, see pages 254 and 260, 262,
19 to 24, see pages 254, 256, 258, 260 –

Page 262 commences a new series of experiments

Plates 1 to 23, to ascertain relation between surface, quantity of solution and loss; these bring in some notes on temperature see page 264
1 to 19, see pages 262 and 264
20 to 23 " " 262, 264, 266, 268, 270, 272 and in Bk 100, pages 4, 5 and 6

Plates 1a to 3a see page 270

Plates 24 to 27, to observe the influence of ~~the structure~~ of copper on ~~the action~~ see pages 270, 272, and 273 also in Bk. 100, pages 4, 5, 6 and 8 —

P Book 100

Plates 28 to 29, to ascertain whether free acid in the solution would not increase and extend the action through a longer period
see pages 5, 6, 7 and 18

plates 30 to 45, relation between surface and loss
see pages 6, 7 and 8

plates 56 to 71 The same
see pages 10, 11 and 12 -

plates 72 to 77 The same
see pages 12, 13 and 14 -

plates 78 The same - both plates this time under as nearly ~~the~~ same conditions as possible
see pages 12, 13 and 14 -

plates 79 to 82, to ascertain whether action of solution would be the same on equal surfaces in equal quantities of solution, whether such surfaces are plane or curved
see pages 12, 13, 15 and 18

plates 83 to 92, relation between surface and loss-
see pages 14, 15, 16, 17 and 18

The loss is proportional to ~~the~~ surface

see 83 to 92

Bk. 100, pgs 14, 15, 16, 17 and 18

is continually decreasing, represented by a curved line

see 1 to 15

Bk. 25, pgs. 238 to 252

is affected greatly by differences in temperature

see Bk 25, pg 266 to 272

also on sheet 2 No. 8

Best solution to use is one containing free acid as then ~~the~~ action extends through a much longer time

See 28 and 29

Bk. 100, pgs 5, 6, 7 and 18

solution in use

15 pts solution in H_2O $CuSO_4$

Sp. gr. 1.13 – 75° F.

1 pt. H_2SO_4 conc.

A less amount of H_2SO_4 might be used

Menlo Park Notebook #102 [N-80-06-28]

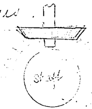
This notebook covers the period June-September 1880. The entries are by Charles Batchelor and relate primarily to the electric lamp. Included are notes and drawings of a clamp-making machine; notes and drawings of cutters, shapers, and testers for bamboo fiber; notes and drawings of instruments for attaching carbons and for bending and tapping wires for clamps; and notes and calculations about a new mercury pump designed on the screw principle. There are also notes on the lifting power of palmetto fans, relating to electric balloon experiments; notes on a pump, apparently for water; and notes and drawings of an electric rock drill. The label on the front cover is marked "Batchelor" and "June 28 80." The book contains 284 numbered pages.

Blank pages not filmed: 100-221, 224-279.

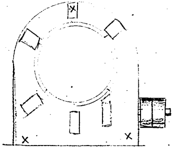
Missing page numbers: 87-90.

Notes on New Clamp Making Machine June 28th 1880

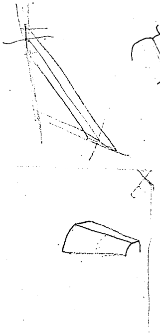
1= Alter position of Cam shaft so ~~that~~ the feeding device shall be driven direct by bevelgear.



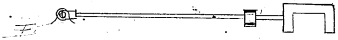
2 Make shape of top part so:-

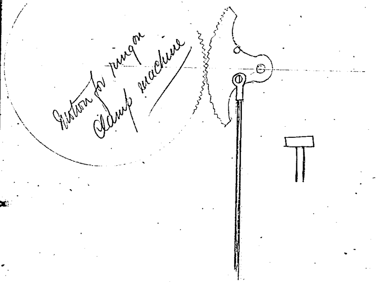


Standing on 3 legs at XXX

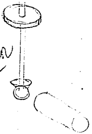


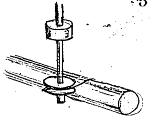
	10·616
2 = 2" cones 12" long =	10·616
1 Keeper $2\frac{1}{8} \times 2\frac{1}{8}$ = 12 lb	15·2
Head ~~8~~ X3 X 3	25 00
	lb. 56

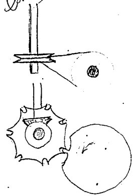


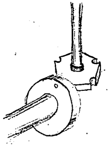


Clamp machine
July 3rd 1880
Chas Batchelor

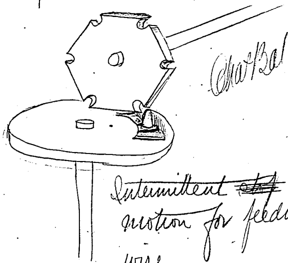








Clamp machines July 3rd 1880

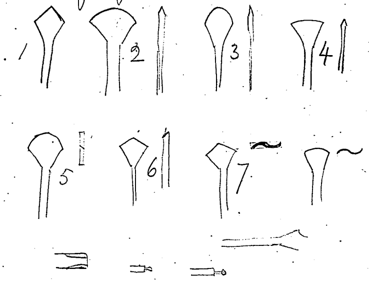


Chas Batchelor

~~Intermittent ~~ motion for feeding wire

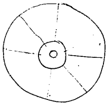
60
4
2400
2400
2400

Centres 4" apart a
1 — 4
large 1
Small 4
What is D of large and small
Drills for platina



3'14
10

31'40



2·7½
2-10¾ — ~~2~~-8½
2-7¼ 1'10
14½

2' 8½
1' 1'
14½

4 Vanes as much

2. 9½   8 9
1. 13   1 11½

2. 8½   8½
1. 10   6

1 6½   7½
9½

2. 8½
1 5
1. 3½

11.75
11.75
5875
8225
1175
1175
1301.3125

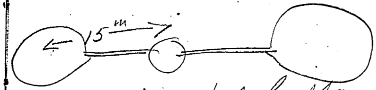
144 1301
36
108
108
216

216/18

216 : 18

216/25922 12
216
432
432

200 revolutions



2 ordinary palmleaf fans
gave lifting power of
12 ounces to square foot

Yellow Jacket

1 Comp. 30" X 12 feet HP. lift tons 200 per stroke
Cond. 60" X 12 " 500

Double line of No 14 pumps lift about
250 feet 10 ft stroke capacity
of stroke 80 gallons 6 to minute
or 480 galls per minute
for each line of pumps

Then what we want is
to raise 960 galls per minute
What height?

960 galls
8 lbs
7680
250
384000
15360
1920000

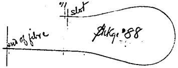
33000
1920.000
640
58 H.P.

7680
32000 / 921.600
460

Bamboo fibres . July 15th 1880

~~E.B. H.P.~~

slot to end Length 4.40 - per cent, Shkge 20/



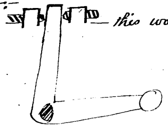
4.40
44
.88 - To make mould to -

Clamp Machine July 20 1880

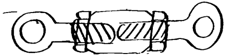
Improvement on model —

1 ~~Shaft bearings~~ made with caps so as to take shaft out

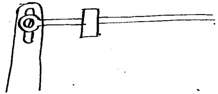
2 Lever for shears to be adjusted so:— — this works the shears



3 Link for punch to be adjusted:—

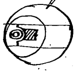


4 Connection between cam lever and 'ring rod' to be positive so:-



5 Shears must be made to stand up an eighth and their points let down so:-

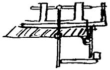
6 Top of button must be larger but position same and top eccentric so as to give more length to the clamp holder.



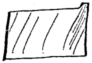
7 Clampholder must be stronger with more bearing and act as a drill jig

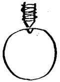
---

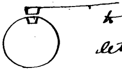
8 In first drilling machine an extra slide must come up and hold jig against the round surface whilst the drill enters



---

9 Monitor ring must be an eighth thicker and the inside edge so:  to keep oil and dirt from joint

10  Instead of button spring like this make one so:- also put a pin



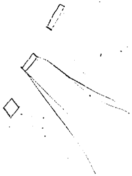
to lift spring out and let go when button has begun to turn.

11 Make all the cams with outside and ~~inside~~ flange

12 Make clutch at least $3\frac{1}{2}$ diameter so as to easily spring back

Distance from centre rim to shaft $4\frac{21}{32}$

N N N



~~[illegible] 10" inside 7"~~

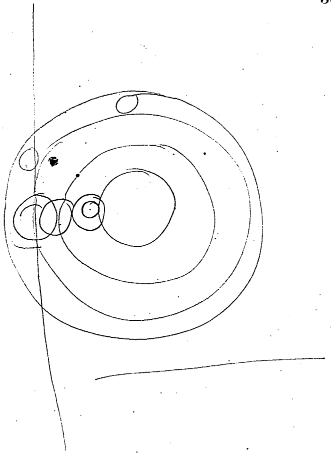
13. Make lock pin lift out with a fork —

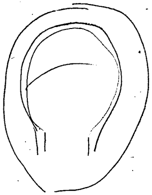
14 Distance from centre of work to centre Cam Shaft

16ths

3 - 6
1 - 5
- 11
13
6 - 3/16

3 - 6
1 - 5
11
5 - 6

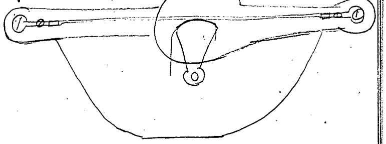


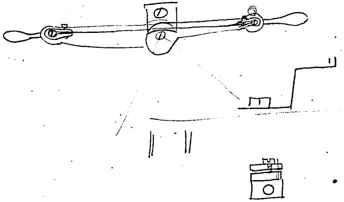


Instrument for bending fibres to shape to test them

July 21 1883

Chas Batchelor

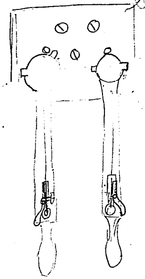


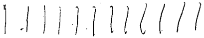


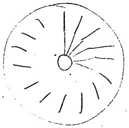
Fibre tester

July 25
1880

Chas Batchelor

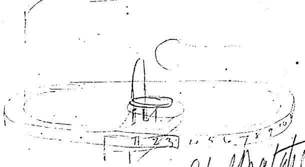




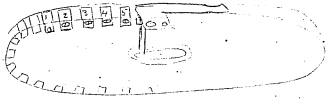


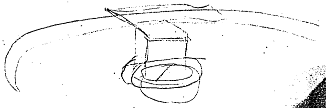
Carbon Liner

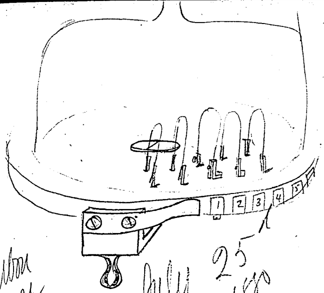
July 25
1880



Chas Batchelor







Carbon pencil

July 25 1880

C Batchelor

25.000 pr mile
300
7.500.000

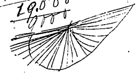
30.000 10 miles
30
900.000

60 H.P.
3
4 lb coal 240 lb
24
960
480
5760

8
2 tons $5 ~~8~~ 9
3 tons Dust coal ~~4~~ 5
2 men 3
2 boys 50
Oil - Waste
$ 1650

120 100 ft
10 000
11.200.000

2 32
300000
8 / 150000
19.000
9000



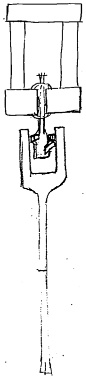
100

1200 1000
1200 grs. in 1 ton
100.000
24 / 120.000.000
30.000.000
200 / 5000000
17 / 250000
21.000

365 / 20000 | 55
1825
1750

Characteristics of a rock drill
Appleton 675

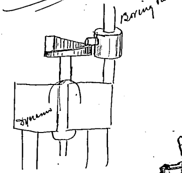
- Variable length of stroke
- Must have rotary motion
- external gear if possible to be avoided
- If stroke is too short it will clog instead of churning up the débris
- Hard rock 3½ in stroke
- Soft rock 6 or 7 inches
- Necessity of wide variation of stroke
Appleton 675 p.
- Necessity of striking a light or a heavy blow

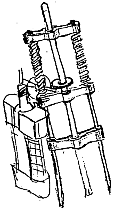


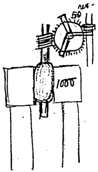
Electric Rock Drill

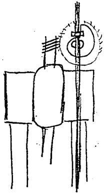
July 25th 1880

Chas Batchelor



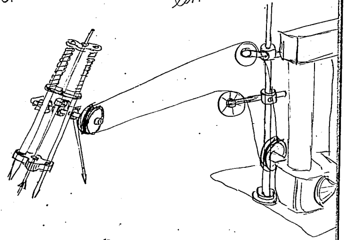


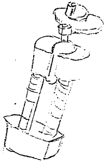




Electric
Rock drill

July 25 1880,
Chas Batchelor

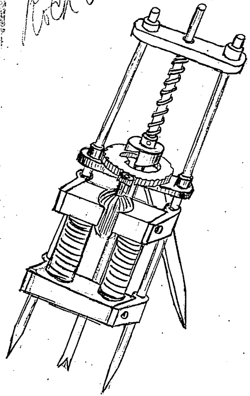




Electric Rock drill

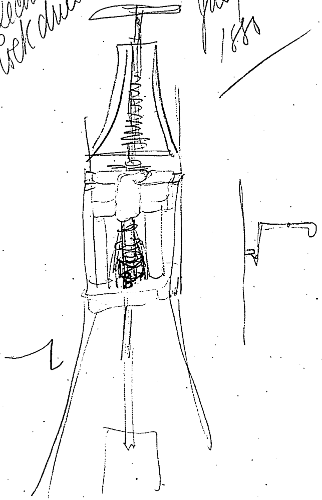
July 25th 1880

Chas Batchelor



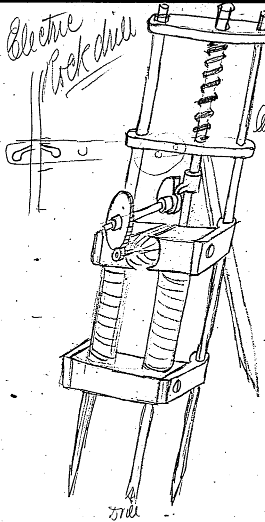
Electric Rock drill

July 25 1880



Electric Rock drill

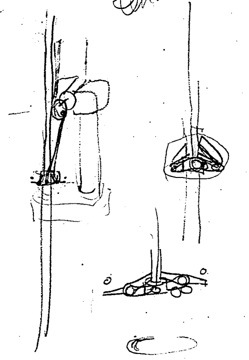
July 25 1880

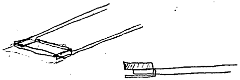


Chas Batchelor
or
how about ~~shaft~~ cam
direct on
shaft

Electric
Rockdrill
lift motion

July 25
1880
Chas Batchelor





Lamps Aug 3 1880

Have John Ott make some
Nickel Clamps

Use Iron screws with all our
experimental lamps at ~~presen~~

Rock drill

Engineering Vol 14 Page 55 —
McKean rock drill

adapted for 500 to 1000 strokes per minute — stroke of piston and fall of cutter $2\frac{1}{2}$ to 3 in —

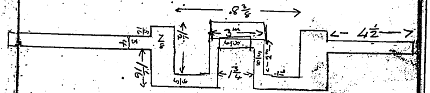
8.26

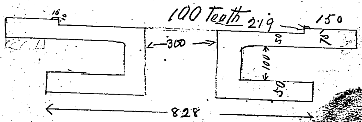
43

Clamp machine bed

Aug 4 1880

Chas Batchelor





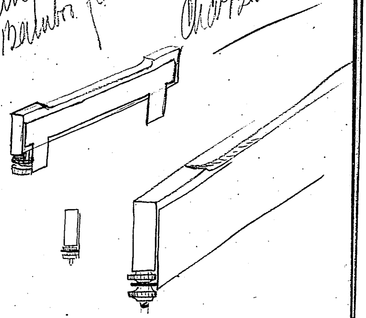
Pitch line 8.18 diam

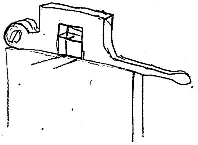
Whole diameter 8.28

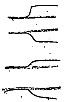
150
219
300
219
150
10'38

Cutting moves
for Bamboo fibres

Aug 20
Chas Batchelor



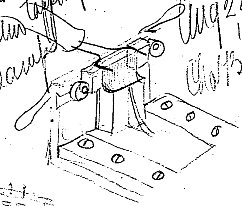


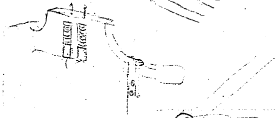


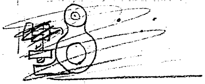
Instrument for boring and tapping hole for clamp

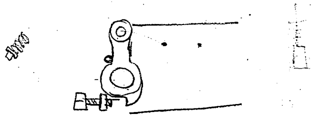
Aug 22nd 1880

Chas Batchelor







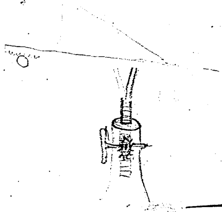


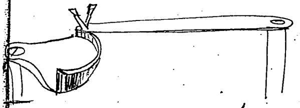
$$\frac{2}{P} = \frac{2}{22} = 22 \,\Big|\, \frac{200}{198} \,\Big|\, 0.09$$

$$.09 + f =$$

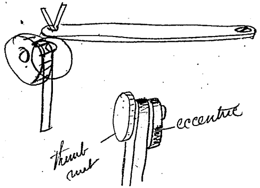
$$D' = 8.18$$

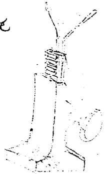
$$D = \frac{N+2}{P} = \frac{180+2}{22} = \frac{182}{22} \,\Big|\, \begin{array}{r} 182 \\ 176 \\ \hline 1.60 \\ 44 \\ \hline 1.60 \end{array} \,\Big|\, 8.28$$

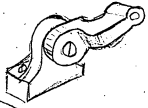


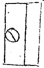


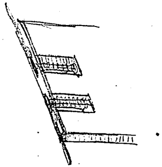
Adjustable support for inside parts

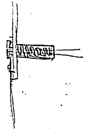


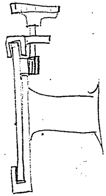




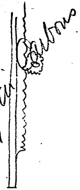




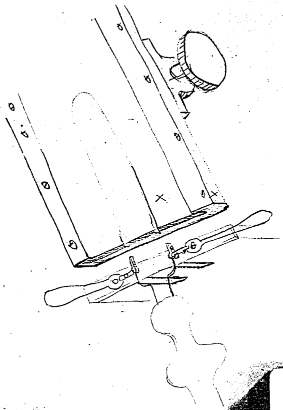


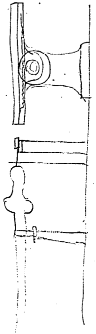


Inst for putting on Carbons



Aug 22d 1880
Chas Batchelor





$12\frac{1}{2}$

Make

~~3·1 2·42~~

$\cdot017 \times \cdot0031 \times 2\cdot42$ makes a lamp.

of

$17 \times 8 \times 3$ $\cdot005$ = 100 R

R.S. 50 - 136

$17 \times 2 \times$ $\cdot038$

R.S. $\cdot038$

$17 \times 3 \times$ 37.

R.S - 40

$\cdot017 \times \cdot001$

R.S. 36

17×3 · ~~3·6~~ 3·5

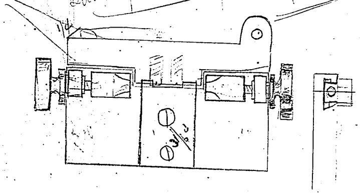
40 - 51·

6·6 8·5

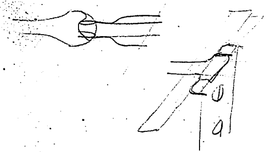
3·3 4·25

49·9 63·75

Machine for bending wires and putting on clamps Sept 1st 1880



Base 12 X 4 X $\frac{1}{2}$



New Mercury pump on Screw principle

$1\frac{1}{2}$ 14 in

$14 \div 11$

$\frac{11}{25} \times 14^2 =$

196
150
225
25

2·46 | 4 | 490·0·0000
249348

$1\frac{1}{2}$
$\frac{11}{12.5} \times 1\frac{1}{2}^2$
2.25
625
450
150
$\frac{1}{1}$ 4.125
2·46

20000 | 272
784
9424
431·152
$21\frac{1}{2}$

1·5
1·5
75
15
2·25

Odde

354

14
4

12.6
2.25
630
252
252
28.350
2.47
19845
9400
5670
70.0245

35
17½

14
4
34
129
1462
120

3550
1750
1200
24

26

295
145
84
1015

2496
216
4
696

Pump.
1½ inside diameter
Centre to centre 12.5
Inside diameter 11.1

$1.5 + 11.1 \times 1.5^2 \times 2.47 =$
cubic inches =

$12.6 \times 2.25 \times 2.47 = 70$
cubic inch
$70 \div 2 = 35$ cubic inch
in one half or $17\frac{1}{2}$ lb

every turn 35 lbs
34 Rev. gives us 1200 lb per min

Always 1015 lbs in Spiral

Double thread round 12 in pipe

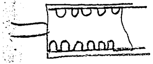
1000
40
40000

Spiral pump
3 threads round 12" pipe

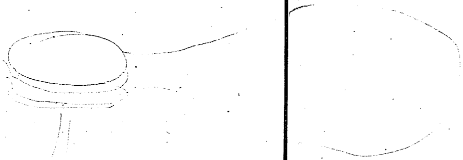
Weight
47/170 less 2/27

160 t foot
13 ¼
480
160
40
2120

If we make a casting and cut thread into it and put on shell =



We could cast the piece and it would weigh about 556 lbs.



8 X 17 X ·6·000 = Solid Content
Radiating S.

12 X 12 X 4 = 576 00 46100

12 X 12 X 6 = 864

3 X 030 X 010 - 9000 72000

576
115
461

100,000
1000000,000
100000000000
10000,000000

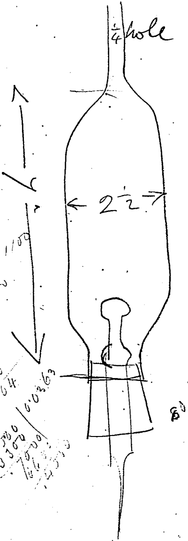
012
012
0001,44
0,12
00017,28

12 144
400
57600

300
50
90000
18000
72000

46100

72



110
1100
8.5
3.25
0.04
0.25

10
110 : 1100
1000
1000 | 40.00 | 0.04
1100

Menlo Park Notebook #103 [N-80-06-29]

This notebook covers the period June-July 1880. It is a continuation of Menlo Park Notebook #42 and includes a summary of lamp experiments from that book. Most of the entries are by Francis Upton. There are also occasional entries by other laboratory staff members. Most of the book relates to experiments with bast fibers and, occasionally, with paper or bamboo. There are also notes and drawings relating to dynamo tests and to tests of insulation for electric railroad tracks and underground cables. The label on the front cover is marked "Upton." The book contains 282 numbered pages.

Blank pages not filmed: 278-279.

Index

Index

60 3 ~~36~~ 9
20 1 $\frac{1}{18}$ cand

65 1.8129
15 1.1761
.6368
2
1.2736
.3010
37.5 candle 1.5746

66 1.8195
14 1.1461
.6734
2
1.3468
.3010
44.5 1.6978

July 20

Continued from Book 42

Goff Bast June 29

11.38 | 190 L.

3½ candles Blue scan

5000 ohms

Fine globules of Hg scattered through the globe.

44 candles

275 L.

Went at less than this

Monkey Bast June 29

Resistance before burning of 790 Ohms

No. 1214

2 candles

265 [illegible]

1.50 31 candles

328 [illegible]

Blue all through lamp - changed to blue at clamps

Monkey Cast June 29?

255 Left 20 cells = 43

7½ candles

blue all gone

She blue appeard at 8-9 candles very faint

272 L at 12 candles decided

2 44 Candles, Very blue

Castra ½ Minute

Regular Bart Lamp June 29.

2,15 Pump started.

Resist cold

6290
6290
6290
6250
6250
7580 ohms

200 (38870
194.35 Ohms

2,35 Heated

1/2 in below tube gauge

5-1/2 candles

250 L.

1/2 in below the tube

6 1/2 candles

2,40 6290
6290

4600

17180

85.9 ohms

7 1/2 candles

245 L.

2,41 284 L.

2,42 280 L.

37 candles blue on
one lamp vacuum
2 1/2 in up tube went
to globe

44 candles

1.9031
1.9031
1.16464
100.7 7.9972
3.4498 2820

1.9031
1.9031
1.6464
7.99~~72~~
3.4232
16 1.2041
2.2191

2650 ft. lbs

165 ft lbs per candle

4.5185
3.4232
1.0953 12.4 per H.P.

240 265 Q

500

258. Q.

29 candles
No blue whistow

16 candles
6290
6290
6250
1310
20140 100.7
2110 Q.
80

14 candles

1500

232 Q ft

1500
6250
6290
6290
20330 | 232
101.6 | 77.3

1.8882
1.8882
1.6464
7.9936
3.4164 2610
14 1.1461
2.2703 186 ft. lbs per candle

2.50 | 280

40 candles high vacuum
No blue - sealed off --
Thirty-five minutes from time
of starting pump
By very carefully looking
a very faint blue
could be seen

1211 Palmetto June 29

3-2	Lamp brought in
3-5	Started
3.30.	58. Left.
	58. Right.
"	12000, ohms and all boxes in, when cold.
3.34	5.½. candle,
"	306. R.
"	302. L
	6250. ohms.
	6250. "
"	6290. "
	6290. "
	5000 "
	2000 " 160
	32080

Palmetto No. 1211 June 29

3.35	7 1/2. candles.
"	4200. ohms. 2000
"	8 1/2. candles.
3.36	4000. ohms
"	6250 "
"	6250 "
"	6290 "
"	6290. " 2000
	300. L.
	300 R.

443000 5.6464
150 2176/1
3.4703.
13 1.1139
2.3564
227

5000
25080
30080
150. Ohms

Palmetto June 29. No. 1211

3.37	9½. candles
"	3050. ohms
"	2000 "
3.39½.	11½. candles,
"	300 R.
"	298. L.
"	5000 ohms
3.42	18 candles

3.43	298. L.
3.43	25,080. ohms.
	49.00 "
3.44.	348. L.
3.45.	67.4. inches
3.47.	65.3/4. "
"	18,830. ohms
"	6700. "
	125536
	127.6

342
114

	2.0569	
	2.0569	
	1.6464	
1277.6	7.8972	4540
	3.6574	
44	1.6435	
	2.0139	

103 ft. lbs. per candle

340. L.

4-20 44 candles

342 R

4-45 Taken off sealed off.

Very little blue in this lamp

170
2
340
113

2.0531
2.0531
1,6464
7.5638
3.3164
16.5 0.9294
2.3870

244 ft. lbs per candle

5,38 7½ Candles

171 Gyr

8 candles

8½ "

171 L.

171 R.

37669
5,42 12000
5000
54669
273.

8½ candles

170 L.

200 / 11769.4
228.9

Willow Carbons - June 29

5,115	39 candles
	37669
	10000
	202 Lit:
	65 1/4 inches
	66 1/2 inches
550	37669
	9100
	30 candles
	195 L
	65 1/2 inches
	8500
	37669
	201 L

2)46569
2328

133 2.1239
2.1239
1.6464
7.6345
3.5287
46 1.6628
1.8559

71.7 ft. lbs. per candle

66.5 1.8228
13.5 1.1303
.6925
2
1.3850
.3010
48.5 candles 6860

Willow Carbon June 29

5-52 66 1/4 inches
200 [illegible] 133 Volts

8900
37669

46569
232

5-58 Broke

This lamp quite blue
extremely hard to make

Summary Book 42 p114

Regular paper

Time	Candles	Total ft. lbs	ft per cand	Ohms
1-50	16	4100	256	94.1
1-55	17	4130	242	92.7
2-	17	4010	238	91.4
2-7	19	4080	214	91.3
2-10	19.5	4000	205	90.3
2.14	21	4040	191	90.2
2.24	21.25	3990	188	90.
3-51	15.5	4060	262	94.9
3.52	16	4040	252	96.1
3-54	19	4100	216	94.6
3.55½	19.5	4081	209	95.5
358	20	4270	213	95.6

Lamp on Pump

Summary Book 42 page 175

Since	Best Candles	Fibre Total ft lbs	ft lbs per candle	New Ohms
10-14	6			
	7			
	9 1/4			
10-18	12	2770	231	125.6
10-20	13.5	2730	202	121.6
10-21	14.7	2700	183	120.8
10-22	16.5	2840	172	119.1
10-23	17.5	2910	166	117.6
10-24	18	2960	164	117.4
10-25	20.5	2900	141	117.1
11-32	20	2860	143	116.

Summary Book 42 page 201

Beast fibre

Time	Candles	Total Foot lbs.	Foot lbs per candle	Ohms
2	5.5	2520	460	121.7
	8	2570	321	119.4
	8.5	2770	326	118.9
	9.5	2800	294	117.1
	11	2820	257	116.1
2-7	12	2790	233	114.1
2-7	12.5	2500	232	110.4
	13.5	2820	209	112.4

June 30

Bast fibre 0".005 X 0".012

0".012 X 0".012 = 144 = C

0".005 X 0".012 = 60 = C'

17½ / 0".034   24½ / 0".048

0".012 X 0".012 = 144

44 candles
from 48 surface
all round
X candles
from 34 surface

44 : 34 :: 48 : X

1.5315
1.6812
8.3565
1.5692

X = 37.1 candles

Let y = candles from side

Then

12 : 5 :: 44 : y

$$\frac{5}{12)\overline{220}}$$

y = 18.3 candles from side

Energy from 0".005 X 0".012

39.1 parts

if 44 parts from 0".012 X 0".012

Resistance = $\frac{1}{60}$ of 0".012 X 0".005

Re— = $\frac{1}{140}$ of 0".012 X 0".012

Let y = E. M. F on 0".005

y_a . ~~R~~ =

$$\text{Const} \frac{a^2}{\frac{1}{140}} = 44$$

$$\text{Const} \frac{x^2}{\frac{1}{140}} = \cancel{60}\ 39.1$$

$$\text{Const} = \frac{44440}{140\, a^2}$$

$$x^2 = \frac{39.1 \times 60}{60 \times \text{Const}}$$

$$x^2 = \frac{39.1 \times 140 \times a^2}{44 \times 60}$$

$$x = \sqrt{\frac{39.1 \times 140}{44 \times 60}}\ a$$

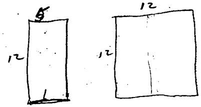
39.11
70
2737.70

44
3
132

$$\sqrt{2.06} = 1.4$$

2.4362
2.1206
.3156

~~Double~~ 1.4 times the E.M.F from same candles



Resistance cold

37,620
12,000
35,000
84,620
423 Ohms.

31,370
6,250
37,620

1½ to ball

1/100 of resist. read

25080
7300
175 L.

195 L.
18 Candles

25080
3300

Bast 5x12 June 30-80

190 L

17½

192 L.
18 candles slightly
blue - not so blue as others
at 11 L-Edison

Turned face to
189 L.
13 candles
3700

$$\frac{\frac{18}{44}}{62} \qquad 31$$

$\frac{201 \quad 2}{402} \quad 134$ 44 candles ~~[illegible]~~

2.1271
2.1271
1.6464
7.5482
3.4488 2810
34 1.4914
1.9574
90.5 ft. lbs. per candle

No 1223
Base 5 x 12 June 30

2950
25080

19½ candles —

200 Left. not much blue not so much as others at 44 — Edison
280 ohms Hot.

18 candles

203 L = ∞

25080
3300
283.

200 R = ∞

6.0 :: 144 :: 105

$$6\overline{)1440}$$
240

$$\begin{array}{r} 144 \\ 105 \\ \hline 720 \\ 144 \\ \hline \end{array}$$

$$6\overline{)15120}$$
252

at 44 candles.
B. P.

	Ohm	Ft. lbs. per candle
Palmetto	127.6	103
~~Batt~~	99.6	101
0".012 X 0".012	107.6	90.5
0".005 X 0".012	283	90.5
0".012 X 0".012	106.6	93.1

46 candles

Willow	232	71.7

Bast 5-4/12 June 30 - 2nd test

10-20 Started pump

37620
22000 Resist cold.

½ in. in tube

11- Heated 130 C.

11-3 Good vacuum.

11,12 Lighted 1 candle

25080
7350 ✓

130 C.

170 C.

4½ candles

3 in from top.

$$\begin{array}{r} 67.6 \\ 2 \\ \hline 135.2 \end{array}$$

250

31

$$\begin{array}{r} 2.1309 \\ 2.1309 \\ 1.6464 \\ 7.6021 \\ \hline 3.5103 \\ 1.4914 \\ \hline 2.0189 \end{array}$$

102 ft lbs per candle

2nd test 0".005 X 0".012 No. 1224

Bast 5 x 12. June 30. 2d test

11-18 188 L.

7 3/4 candles

185 R.

157 L.

25080 }
2300 } – very faint blue

11 22 203 L.

1.8 candles

25080

11-30 Broke

87 1.9395
1.9395
1.6464
81.0685

3.5939

3920

Galva 3920 ft. lbs
Calor 3810 " "

5939
5807

.0132

1.03 %

20 cells 65 R & G

1-29 Temp. air 85° F.

1-30 Started

Temp H_2O 72°.25

85
72°.25
12.75
85
97.75

6290
6290
4500
17080
8540

1-33 261 R = D
260 R = D

87 Volts

1-35 4450 Ohms
260 R - D

1-39 Stopped 96°.5 F
72.25
24.35

1.0515 Kilogramme

2.204 lbs to 1 Kilo

44.5 ~~Gramme~~ Comps

203 Cu Vessel

44.5

247.5

1.0515

2475

.8040

20

.824

2.204

775

Comps 9

24.35

7.9159

0.3432

2.8893

9.0458

1.3865

3.5807

3810

Current put on suddenly and broke carbon

Pump became very dirty and Hg ran back into lamp.

Book 63 page 37

A filament of manilla carbon estimated as 0".005 in diameter 2".4 long
resistance cold 505 Ohms
resistance 62.490 Ohms per mill foot
or 5.207 per mil inch

A Bast fibre 0".012 X 0".012
195 Ohms cold
85.190 Ohms per mil foot
7,099 " " " inch

Manilla 5.207 per mil inch
Bast 7.099 " " "

Comparison $0''.012 \times 0''.012$
$0''.007 \times 0''.012$

Book 63 p. 150
$0''.007 \times 0''.012$
at 27 ~~candle~~ corrected for two sides
27 candles
142 ft. lbs per candle
$0''.012 \times 0''.012$
Book 42 p. 239
29 candles
132 ft. lbs. per candle

Box of Cells 1	211	= D
2	211	
3	211	
4	213	
5	211	

Standards all good June 30, [illegible]

1.9375
1.9375
1.6464
74.0 8.1273
3.6487
4.5185 4450
.8698 7.4 per H. P.

3.6487
1.5051
2.1436

140 ft. lbs per candle

1260 = D
86.6
6290
6290
2350
14930
74.6 Ohms
32 candles

Bast fibres

0"005 X 0".012 July 1.

Very bad spot in one side.
ex tremely blue
went immediately

20 cells = 43
1 Volt = 2
Resistance 100 times

10.44 5.34 c

" 31,370. ohms. 403.7 ohms
" 9,000.

" 260. L.
" ½ 262. R.

Very faint tinge of blue on top.

Bast fibre 0".005 x 0".012. July 1. Fa.

10.48	8. 3/4. candles.
10.50	312. L.
	316. R.

Very high vacuum.
At the top of the lamp a bad spot and blue around it.
The lamp when it broke was filled with blue. One side of carbon incandescent the other red with red clamp.

1600 : 2454 :: 80

80

196320

122 Volts

5' 2930

3' 2041

2.0889.

July 1-80

Wrought iron motor

92 Volts running 11 lamps

94 Volts all lamps off

100 Volts after short time

.1227

2454 revs p.m

200 Volts on magnet

115 Volts from armature when saturation

7 1/2 permanent

102 Volts no lamps

92 Volts on lamps

18 ohms in with magnet

90 volts

11-40	32 ohms in with magnet 88 Volts
12-5	86 Volts

Bast fiber 0".005 × 0.012

11.45	37600 } No cold 22000 } quite an even carbon 31370 } 9400 } 268 Ω 5 Candles 5½ Candles No blue
11,52	31370 8800 275 Ω 8½ C.

11.55 8000
31370

13 C
very faint blue

278 L.

7000
31370

12 — 15 C. blue all through globe
295 L.
6000
2 31370
Sealed off —
Tried resistance box
30.1 Ohms = 30100

Bast fibre July 1. 80

Clamps large

14½ candles

190 L.

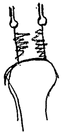
18830
5900
24730
123.

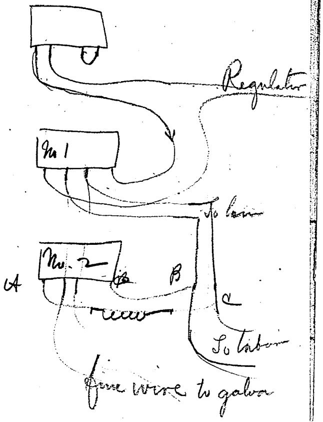
210 L. Very blue
210 R 65 inches

175 L.

14 candles very slight small blue, bad spots in carbon, a little Hg in bulb

Clamps




Regulator
No 1
No. 2
A
B
C
fine wire to galva

Election expens.

1100

$\frac{\cancel{314}}{}$ 157 $\frac{10}{\cancel{12}}$ 6

6) 157
2.6
1100
2600
26
280 0.0

5500

400
400
160000
44
640000
64
2) 7,040,000
20) 3,520,000
176000

Ea 39
6
234 turns on present
small machine wrought in
75 volts at 1600
since then E. E. ~~gives~~
5500 r.p.m. the ~~same~~

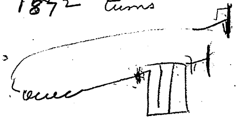
33000
5
165,000

be about twice as strong

234 : X :: 75 : 600

$$\frac{\frac{3}{4}}{6} = \frac{6}{8}$$

$$\begin{array}{r} 234 \\ 8 \\ \hline 1872 \end{array}$$ turns



Webers

185
19.
37.5
524

1.5740
.27193
8.8547
2.8373

.0715
.0687
.1402
.0701

(41
13.6
.07
.952

(49
16.3

Plan of arrangements
~~page~~ 87

On magnet ~~7 9~~ 18.5

Total 262
263

20 cells = 6.5
65

From M 1 41 L
41 R

No 2 49 L
49 R

$\underline{\lfloor 66.7}$
22.2

$\underline{\lfloor 51}$
17
.07
1.14

4-34	No. 2	66.5 L
		67 R
	No 1	51 R
		51.5 L
4-42	No. 1	53 L
		52 R
	No. 2	69 R
		69 L

4

67	96
22.3	32
.07	
1.561	

80	118
26.6	39.3
.07	
1.862	

	No. 2	80
	No. 1	42
	Magnet of No. 1 broken	
	No. 2	82 L
		82 R
	No 2	96 R
	No 1	67
4-50	No. 1	80
	No. 2	118

100
33
.07
2.31

148
49.3

155
51.6
.07
3.612

220
78.3

220
73.3
.07
5.131

267
89

22 1.3424
320 2.5051
.0687 8.8373

No. 2	148
no. 1	100
No. 1	155
No. 2	220
No. 2	267
No. 1	220

Otm magnet 22
On line 320

Changed by by taking the resistance out of the line with
No. 2 355

$\frac{118.2}{3.06}$

97

Now Three Ohms
in line with magnet
of No 2

Now
Fixed so that magnet
is on direct line to galva

No. 2 = 270

On magnet 16 L
15.5 R

17.5 R

Magnet 18.5 L
18. R

Armature 291 R
292 L

Armature	316 L
Magnet	24 L
	23 R

1048 revo.

~~Armature~~	~~36 R~~
Magnet	40 L
	40 R
Armature	370 R

armature	333 R
Magnet	27 R
	27.5 L

20 cells. made	43 L
	42.5 R

Magnet 35 R
36 L

Armature 248 L

Armature 255 L
Magnet 48 L
47.5 R
Armature 254 R

Short circuiting gave
150 Volts
145

233 convolutions
6
1398 Convolutions on magnet

$$\begin{array}{r} 20 \\ 8 \\ \hline 28 \end{array}$$ Gamm

28 H.P. gives 37 [illegible]

Regular bast ~~[illegible]~~

12 | 16 candles 101. Ohms 165 ft lbs per candle
13 | 14 " 186
35 | ~~14 [illegible] Ohms 183~~
~~16.5 [illegible] 120 172~~

Palmetto 150 Ohms

page 20 13 candles 227 ft lbs per candle

Bamboo

171.5 5.6667 15 candles
7.7652
3.4316
1.1761
2.2555 182 ft lbs per candle

Bamboo Fibre

July 13

15 candles

6250
6250
6290
6290
9200
34280

171. ~~[illegible]~~ Ohms

.308 = V on H.R

102.6 Volts

102.1 2

2.0100
2.0100
1.6464 5.6664
7.9172
3.5836

115)3830(255
30
83
75
80

Bamboo Fibre 0"012 X 0"012

2-14	48 candles or 66.5 inches No blue
2-25	Stopped to Exper Started again about 1/2 minute
No. 1262	Lasted about 1/2 minutes

Both went in the clamps no cross conductor from fibre to fibre

11 1/2 minute

1150 Ohms Total
5.0 Ohm Conductors
6.5 Ohms one side

7.75
5.
2.75 Ohm One side

7.25 Both sides
2.5
4.75
~~2.25~~
~~7.50 Ohms Each~~

6.5
2.75
9.25
4.62

6.5
2.75
9.25

Insulation R. A. July 13.

~~4000~~
~~2~~
Track to track 10 Ohms

$\frac{2300}{200}$ One track to ground

$\frac{2950}{200}$

$\frac{1550}{200}$ both tracks

More current

$\frac{1450}{200}$

$\frac{4000}{200}$ = 20 Ohms
10
10 Ohms

Conductor $\frac{2020}{200} = 101$

Results

resistance on wet lay from track to track
10 Ohms

One side to ground
6.5 Ohms
Other 2.75
9.25 Ohms

Both sides
4.5 Ohms
2.5 Ohms

20
.15 3/4
.20

365
15
1825
365
5475
547.

25.
600.
15000.

15 M

15) 4.61 (.30 cts
45
110

30
4.7
34.7
8.6
26.1 cts

Estimate

600 Lights. 3 1/2 lbs of coal per H.P. in the current.

Five hours.

6 lights per H.P.

100 H.P

350 lbs of coal an hour

7 350
35 5
~~175~~ X 1.65
~~22~~
45

1.65
7
9) 1225
1.36
25
300
4.61

Oil waste .25

Engineer 3.00

Money invested

6.500

Depreciation 4%

6,500.
.04
365) 26000 (.071
2555
450

15) .71 (.047
60
110

✻ 3808 ft. lbs. for 17 candles
Resistance 114 Ohms

3808 . 3.5807
17 . 1.2304
2.3503
224 ft. lbs per candle

3842 3.5845
16 1.2041
2.3804

240 ft. lbs per candle

✻ Book 104 page 28-29
Lamps No. 1253

Galva

83.3	1.9206
8	1.9206
86.4	1.6464
	8.0635
	3.5511

3560 ft lbs

10-27 69° ~~7~~

Started

Temp. air 81
69
12
81
93

250 R
~~2~~49 L

3(250
83.3

6290
6290
4760
2(17280
86.40 hms

92.125
69
23.125

10-37 92°.125

3560
3280

3.5511
3.5159
0352

1.08 %

.831 9.9196

Page 61 0.3432 |||

2.8893

Comp. 10 9.

23.12 1.3638

3.5159

Calor 3280 ft. lbs

Wt. of vessel & H_2O

1.058 Kilo
.247
.811
20
.831

74.3 1.8710

1.8710

1.6464

89.9 8.0462

3.4346

Galva

ft. lbs. 2720 .4116

.0230

1.05 %

Calor. & Galva.

11-22 70°.5 F

Started

82

70.5

11.5

82

93.5

223 = D

74.3 Volts

6290

6290

5400

17980

89.9 Ohms

11-35 93°.9 F

11-22 70.5

13 23.4

Calor of Galva.

1066 Grammes
247
819
20
839 — 9.9238
6.3432
2.8893
Comp 13 8.8861
23.4 1.3692
Calor 3.4116
2580 ft. lbs

.84 1,9243
1,9243
116464
71995 7
3,490/7 3100
16 1 204 1
.296 6

198 ft.. lbs. per cand

Bast 0".012 X 0".012 Ends diffed in Pt. solution
~~Bamboo~~ Fibre No. 1265

16 candles

6290
6290
6250
1200
20030 100.15

252 L
252 R
8.4 Volts.

101	2.0043
	2.0043
	1.6464
141	7.8506
	3.5058
18	1.2553
	.2303

3204

178 ft. lbs per candle

~~Bamboo~~ Bast Fibre No. 1266 0".012 X 0".012

~~17.25~~ Candles
18 candles

6250
6250
6290
6290
~~3420~~
28280

1414 Ohms

303
101 Volts

1.9926
1.9926
1.6464
140 7.8539
3.4850 3060
15 1.1761
.3094

204 ft. lbs. per candle

~~Banister~~ Rust No 1266
0"012 X 0"012

15 candles

129.5 = D
98.3 Volts

~~Same resistance start~~
~~before~~

140 Ohms

111.6

126.6

4350

2.0477
2.0477
1.6464
7.8975
3.6393

4300
8
34400

Burst No. 1266 0".012 X 0".012

Soaked at clamping part in double chloride NH_4 & Pt. Book 57 page 155

~~44 candles~~ 66.5 inches
48 candles on bar

2-51 Started

Not much blue

6290
6290
6250
6500
25330

126.6 Ohms

1335

111.6

3- Went very suddenly clamp red hot

9 minutes

4.5185
3.4413
.1.077 2

12 per, 11

2
2
42 11.6464
160.4 7.7949
3.4413
2760, 1.2041
.2372

172 ft. lbs per candle

~~Rattan~~ 0".012 X 0".012
~~Bamboo~~

16 candles
300 = D 17 candle Edge

6250
6250
6270
6290
7000
32080
160.4

2.0607
2.0607
1.6464
7.8374
3.6052 .4030

Bamboo 0".012 X 0".012
regular size

3-15 66".5 ~~ona~~ bar
or 48 candles

$\frac{345}{115} = 0$

4000
6290
6290
6250
6250
129080 145.4

3-24 Went out

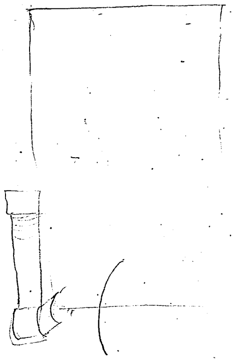
Black on clamp  carrying

9

Bask No. 1265 July 14. 80

Reversed current

4-14	Started 48 candles
5-55	Broke
4 14	
1-41	1^h 41′
	60
	101 minutes
	Slightly blackened the
	glass near the clamps



July 16 –

Test insulation of lines underground

Conducting wire

200/25.20
12.6 Ohms

18 wire circuit
6290
7820
(14110
70.5
12.6
57.9 Ohms insulation

Carmen circuit

(2800
1400 Ohm
12.6
1.40 Ohms

With ground
~~1.9~~ Ohms
2900

$$\boxed{\frac{8000}{200000}}$$

$$\frac{\quad 7}{14000}$$

Carmen Circuit

One side

20 | 21.00 Ohms

10.5 Ohms other side

$$\frac{6.3}{4.2}$$ Ohms

$$\frac{\overline{)12.6}}{6.3}$$

4.2 Ohms to ground

$$2\overline{)2900}$$

14.5

$$\frac{6.3}{8.2}$$ to ground

Insulation conductors

6 wire circuit

6290
6290
2300
14880
74.4
12.6
61.8

One side ground

6290
100
6390
31.9
6.3
25.6

other

6450
3225
6.3
25.95
25.6
50.5

Insulation conductors

Edison's lines

One side with ground

2 | 24.20
12.1
6.3
5.8 Ohms

| 3.150
15.7
6.3
9.4
5.8
2

| 2850
14.25
12.6
1.65 Ohms

Insulation Conductors

Page 145 conducting wires from galvanometer 12.6 Ohms
18 wire circuit

6290	67.4
6290	12.6
900	54.8 Ohms
13480	
67.4	

More E.M.F

6290	63.9
6290	12.6
200	51.3
12780	
63.9	

One side with ground

6290
31.45
63
25.15 Ohms

Othe side

	25.1
6290	42.9
2300	68.0 Ohms
8590	
42.9	

July 16 1880

	Wire to wire	grounds	
	Ohms	Ohms	Ohms
18 wire circuit	55.	25.	43.
Carmen circuit	1.4	4.2	8.2
6 wire circuit	61.8	25.6	50.5
Edison's line	1.6.	5.8	9.4

The weather has been raining for two weeks and the ground is thoroughly wet. Houses on Edisons and Carmens circuit.

Lamp No. 126 & Bast
Reversing current

11-43	Very rapid reversal Reverser N. G.
	(3150 1575 Edisons line 126 House off 3.15 Ohms noon

Conducting circuit

Carmen's July 16

2.P.M. 2 |2950
147
12.6
2.1 Ohms

4 P.M. same

One side
|3000
15.00
6.3
8.7 Ohms

other 8.95 Ohms

2.0277
2.0277
1.6464
7.7878

3.4896 3080

Lamp 1283 Bamboo

16 candles

6250
6250
6290
6290
7650

32730
163.6

163.6 Ohms

3.20 = 0
106.6

Lamp 12.8 b Bamboo

	42 candles
3-34	Less than 8 minutes

Nos. lamps in case

1274 Bast fibre ends soaked Book 57, p 159

1268

1271 Bast fibres

1270

1272 Book 57 157

1275 Bast

1269 Bast Book 57, 135

Larmen's line

$$\frac{28.50}{2} = 14.25$$

$$\begin{array}{r} 14.25 \\ 12.6 \\ \hline 1.65 \end{array}$$ ohms

$$\frac{18.00}{2} = 9.$$

$$\begin{array}{r} 9. \\ 6.3 \\ \hline 2.7 \end{array}$$

$$\frac{18.00}{2} = 9.$$ Ohms

$$\begin{array}{r} 9. \\ 6.3 \\ \hline 2.7 \end{array}$$

P.M. 2900

Gas jet July 17-80

	Ground glass
13	11
12.5	10.5
12.5	10
12.75	11
13.	11.25
5)63.75	5)53.75
12.75	10.75

E. L.

Large Ground glassglobe

12.5
12.5
14
39.5
13
8

39
5

9.75
9.75
11.5
31.00
10.3

0.9031
1.5911
9.3120

20 %

26

6290
2
12580
6250
18830
3500

20)22330(111
2
23
20
30

18830
3500
20)21830(109
20
183
180

3)285
95

95 1.9777
1.9777
1.6464
7.9547
~~3.5975 3950~~
3.5565 36 ans

269 = 20

Rs 6290 × 2 + 6250 + 3500 = 111 days

Def 285 at 12.20 C

Def 295 Res. 109 ohms
at 16 C

at an angle of 45°
it gave 19 at 90° it
gave 14

July 17-80

In frosted globe

~~293 ...~~

295 = D

293 = D

14

14

12.5

80
66.5
~~135~~

No 1279 Beast

253 Volts
1.5
44 candles

2-41

6290
6290
7990

3-5 Went at clamps in glass cracked

14 minutes

P

Port

Francis

Portland

30 / 15

Bost
Lamp No. 1271

3-19	Started
	255
	44 candles
	6290 × 2 + 6000
	6290
	6000
	18580
	929 Ohms
	Ohms
4.21	Busted
	2

Bast
Lamp No 1272

4.31 at 44

433 [illegible]

Lamp 1270

319
106.3

2.0265
2.0265
1.6464
79.9 8.0975
3.7969

6260

.463 9.8938
0.3432
Page 61 2.8893
19.5 1.2900
comp 4.5 9.3468
3.7631

5800 ⑧

3.7969
3.7631
.0338

1.08%

Temp air 77° F

10-8 Started
Temp H_2O
67.4

319 K. R

$$R = \frac{\begin{array}{r}6290\\6290\\3400\end{array}}{15980}$$ 79.9 Ohms

10-12-30 Temp 86°9 F

86.9
67.4
19.5

1010 Ogrammes
247
763
20
783

100 R

70 x

$70 : x :: 100 : R$

$x = \frac{70}{100} R$

Bucket of Tar July 19

~~100~~
70
100

6290
4
25160
25000
12000
7 | 62,160.
7
435186 Ohms

Wrong this is an estimate of galvanometer Tar with plates then

20000
40000000

needle did not move when current passed through with all resistance out on other side. The tar seems to be all right

1.8954
1.8954
1.6464
7.9890
3.4262 2670
7.12 9.1475
2.5737 375

Bast No 1275 July 19

7 1/8 candles

235
237 (236
786

65 = 20 cells

R 6250
6290
6290
1900
(2.0530
102.65 Ohms

1.9101
1.9101
7.9864
11.6464
3.4530 2840
8.6 0.9345
2.5185 330

Biast No. 1275 0".012 X 0".012 July 19

8.6 candles

244
244
81.3 volts

6290
6296
6250
1820 18830
20650
103.25

1.9207
1.9207
1.6464
7.9898

3.4776 3000
9.8 0.9912
2.4864 306

$\frac{16}{8}$ 33000
128

4.5185
2.1072
2.4113
258 ft. lbs per candles

Bast No 12 75

9.8 candle

250 H.R
83.3

18830
1650 Ohms
20480
102.4

~~2.0255~~
~~2.0025~~
1.6467
1.9375
1.9375
7.9946

~~3.2961~~ ~~1970~~
~~1.1461~~
~~2.1600~~ 3320
3.5210
1.1461
2.3749 237

Bast 1275

14 candles

260 H. R
86.6

18830
1300 ohms
20/30
100.6

1,9474
1,9474
1,6464
8,0039

3,5451   3510

Bust 1275

175 candle

1266
886

1000 Ohms
18830

19830
99,15

2.0055
2.0055
1.6464
8.6487
3.7061 5080

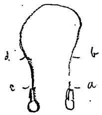
Bast 1275

48 candles 66½ inches

8-40 | 304 101.3

6290
6290
5300
17880
89.4 Ohms

8-53 Broke 13 minutes



Clamp black
a-b, c-d black rust steel color

1.9694
1.9694
1.6464
7.9028
3.4880 3080

Bast No. 1270 July 20

Very regular
17.5 candles

280 = D 73.2
281R = D
6250
6290
6290
6200
25030
125.15 Ohms

2,0386
2.0386
1.6464
7.9431
3.6667   4640

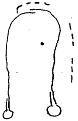
Bast No 1270   July 20

48 candle

9-20   328
109.3

6250
6290
6290
4000
22830   114

9-27   Went   7 minutes



Black

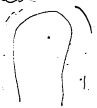
Clamps black

1.9411
1.9411
1.6464
7.9578

3.4864   3060

Bast 1268

at red



Brightest spots marked outside

1278

15.5 candles

262
87.3 Volts

6250
6290
6290
3300

221 30
110.65

Beast 1268

Last one minute

Broke in two places

Book 57

✓1282 Bamboo p 163

1283 Dipped Chl Pt

1284 0.″012 X 0.″012

✓1285

✓1286 Bamboo 0.″012 X 0.″012

✓1287 Ends $\frac{3}{32}$″ wide

✓1288 Bast syrup

✓1289 Book 57 p 163

1290 Bamboo ~~Bast~~ 0.″012 X 0.″012 p 165
Ends $\frac{3}{32}$

1291 Bast p 165

1292 syrup
Ht ends

1293

Bamboo 0.″012 X 0.″012

1294

1295 Carbonized flat ways
Ends 3/32 p 167

1296 Bamboo regular
flatways p 167

~~1297~~

1298 Bamboo

1299 pt. Ir 10 ay

1,9685
1,9685
1,6464
7,9281
3.5115   3250

Bamboo • No 1282 July 20

at red perfect
Dents some distance from
clamps

1.6 candles
(279 = D
9/3

6250
6290
6290
4800
236.30   118.15

On one side white hot
into the clamps small piece
broken off and leaves filament
as black. Other side red
into clamps

2.0346
2.0346
1.6464
7.9788
3.6944 4950

10-18 44 candles
325 = D
6290 108.3
6290
8400
20980
104.9 Ohms
The light for a
~~11-18~~ time was somewhat
lower and for a
time 333 = D The
engines varies consider-
ably

11-18 Stopped to test
lines
Edison took away to
examine

Bamboo No 1285

2.0067
2.0067
1.6464
8.0398

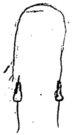
3.6996 5010

5000) 33000 (6.6

10-1 86.5 inches
= 48 candles
No blue
305
101.6

6290
6290
5670
18250
91.25

10-23 Went at above clamps



523	2.7185
132	7.8794
20	1.3010
1.08	0.0334
85.5	1.9323
	1.9323
	1.6464
	7.9605
	3.4715

2916

~~Boast~~ Bamboo No 1299

Pt. Ir 10% foil around carbon at clamp — 0"012 X 0"012

16 candles

6290
6290
6250
3100
21930 109.6 ohms

Bu cells 65
67
132

260
263
523

400
300
220

1.9850
1.9850
1.6464
8.0128

3.6292
4.5185

.8893

4350 ft. lbs.

7.75 per H.P.

Bamboo No 1299

4-12½ PM — 48 Candles

290 H.R
96.6

6290
6290
6250
~~600~~

19430
97.15

4-50 Blue flame at the clamps

5-5 Went

60
12.5

975
5

525

13.5 candles

13

350
116.6 2.0662
2.0662
1.6464
205 7.6882
3.4670 2930
4.5185
1.0515

11.5 per H.P. of 17 force

Regular paper old model
No 1280
July 21.

Gas shots not very marked
£76 deflection

17 candles

6290
3
24870
6250
.6250
3800
47170 205

175 + 175
1.5 +

7½ candles edge

2.0952
2.0952
1.6464
7.8013

3.6381 4340

Paper No 1280

66 1/2 inches on bar

9-29 $\frac{1202}{67.3} = 0$

67.3
2
124.6

6290
6290
6250
6250
6500

9-32 $\boxed{31580}$
157.9 ohm

1.9542
1.9542
1.6464
127.6 7.8935
3.4483 2810

Bamboo No. 1286

0".012 X 0".012

Ends $\frac{3}{32}$"

15 1/2 candles

290
90

.6290
6290
6250
6250
~~44~~50
25530
127.6 Ohms

2.0224
2.0224
1.6464
7.9494
3.6466

4307

Bamboo No 1280

66 1/2" in bam
Some blue in lamp

10-48 | 316
105.3

3650
6250
6290
6290
22480
112.4

11— | Went

Bamboo No 1287

Good carbon
66½ inches or
48 candles
went in one minute
very high resistance

1.9850
1.9850
1.6464
7.8465
3.4629 2900

Bast 1289
poor vacuum oxydized

Bamboo
No 1290

Bad ~~spot~~ in bottom of
loop for 1/2 inch (thin) –

16 candle

290
96.6

9650
6250
6290
6290
28480
142.4

2.0306
2.0306
1.6464
7.9103
3.6179   4150

Bamboo
~~Boot~~ No 1290

48 candles 66.5

11-20

322
107.3

6250
6290
6290
5750
24580
1229

11-25 Went

1.9854
1.9854
1.6464
7.8894
3.5066   3210

Bast
No. 1291

15 1/2 candles

292
290   96.7

6290
6290
6250
7050
25880
129

2.0453
2.0453
1.6464
7.9531
3.6901 4900

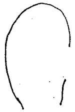
Best
1291

11-33 66½ inch

333
111 Volts

3450
6290
6290
6250
22280 111.4

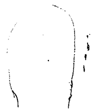
11-45 Went
33
12



1.9939
1.9939
1.6464
7.8511

3.4853 3050

Bast 1288



bad place

16 candles

296
98.6

9356
6256
6290
6290

28180
140.9

2,0569
2,0569
1,6464
7,9211
3.6813 4800

2.0477
2,0477
1.6464
7.9156
3.6576

4540
4600
19340
4670

Bast 1288

11-55

86".5

342
114

5150
6290
6290
6250
~~23980~~
~~119.9~~

~~Again~~

5450
6290
6290
6250
24280
121.4

335
111.6

12 —

~~Went~~

Clean breaks on one side

1.9850
1.9850
1.6464
7.8636
3.4800   3020

Burst No 1292

Bad places

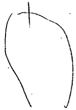
16 candles

~~290~~
~~96.6 Volt~~
18830
8550
27380   136.9

Slight blue

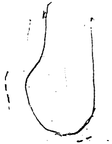
Bast no 1292

	48 cand
12-9	337
12-11	Went This was brought somewhat higher than 44 candles
	At top



2.0306
2,0306
1.6464
7.8164
3.5240   3340

Bamboo
No. 1295 Carbonized
Platinums



15 3/4 candles

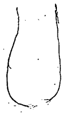
(322
107.3

5450
6250
6250
6290
6290
(30530
152.6

Bamboo
No. 1295

66 1/2 inches

Very high for a
moment went

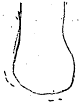


About 1 minute

2.0140
2.0140
1.6464
.717997
3.4741   2980

No. 1294   July 21
Bamboo

Label



16.25 candles
310 = N
103.3

6650
6250
6250
6290
6290
31730
1586

a little blue in globe

No. 1294 Bamboo

66 1/2 inches
44 candles

2-10 Went at top
2 minutes about
Very carefully brought
up so as not to exceed
48 candles

Bamboo
No. 1296 flatways

Good carbon

15.5 candle

No Galva

4300
6250
6250
6290
6290

29380

14.69 Ohms

2.0346
2.0346
1.6464
7.8749
3.5905   3900

Bamboo

No. 1296

2-24   86.5 inches. 48 candles

Very carefully brought up so as not to exceed 48 candles.

1600
6290
6290
6250
6250
26680
133.4

325
108.3

2-50   Went
24
26

Bamboo No. 1300 July 21

Reversed current

4-37	48 candles
4-41	4 minutes
	This showed ~~a bad~~ a bad spot at the bottom. With constant current should not expect it ~~to last~~ to last more than one minute.

Jul 21 80

Bart regular 0".012 X 0".012 X 4"
Reversed current

4-47	66.5 inches
	48 candles
	Should expect to last less than ten minutes as it had a bad place
5.7½	went.
13	
20½	minute

1.9460
1.9460
1.6464
7.9338
3.4722

2920

Jap. Bamboo V = 112

Slightly thin 

16 candles slightly

4450
6250
6290
6290
23280
116.4

265 = N
88.3

2.0182
2.0182
1.6464
7.9605
33

No 1312 July 22 1880

9-6 | 48 candles 66½ inches
Globe very blue

6250
6290
6290
3000
21830
109.15

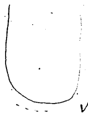
313 = Δ
104.3

before 9-17 | blue entirely left the lamp.

9-21 | Went slightly more than 48 candles
No carbon on clamps
15 minutes

No 1311 July 22-80

Jap Bamboo



very slight brightness

16 candles

An extremely faint blue in lamp

265 = Ω
88.3

3700
6250
6290
6290
22530
112.6

Lamps No. 1311
Jap. bamboo July 22

One side in clamps broken

10-57 48 candles
Very blue completely filling globe
32 # = D

6290
6290
6850
800

11-11 E. M. F. constant
First a flickering blue
then entirely clear

11-17 W cut it short
deposition on clamps very high vacuum.
20 minutes

No. 1301 Extremely good carbon Feb 2.2
Bamboo Regular

V=112

	Reversed currents 48 candles
11-28	213 = D
	blue in globe Higher than 48 candles
11-46	Blue in globe disappeared
11-54	Went
	This lamp had run up much higher than 48 candles on account of reversing key running slowly

Bamboo

2-8	Reversed currents
	212 = D
	48 candles
	Quite blue
2-21	Went in at spot

Bamboo
reversed currents

~~4-14~~	Very little blue
	good carbon
	Big mistake went
	very high
4-14	48 candle
	66.1/2 [illegible]
4-18	Went

Edison

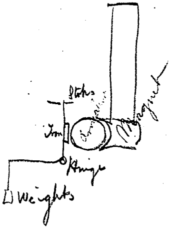
Pt. Iridium .005, 10% to

be brought up to one candle or less in the air, exhaustion then measured as the air is exhausted. Edison

Carbons to be sealed in small and large globes and carefully measured then lifted and measured 5 of each kind Edison.

Lamps to be sealed with Mac Leod gauge and vacuum tested from time to time Edison

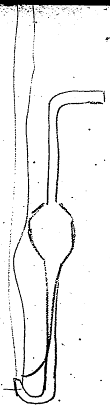
for armature without wire on to be revolved in front of a magnet and the magnetism in it tested.

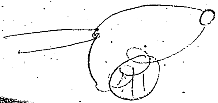


Try the weight at rest and at motion,

Edison

Test relation between magnet and armature of both machines and small wrought iron motor





Menlo Park Notebook #104 [N-80-07-05]

This notebook covers the period July 1880-February 1881. All of the entries are by Francis Jehl except for one drawing by Edison of a lamp with a spark gauge. Included are notes, calculations, and drawings of lamp and vacuum pump experiments; notes on motor and dynamo experiments; and notes and calculations about meter experiments. There are also notes and calculations relating to battery tests, resistance tests for wire and electric railroad track, tests of copper wire, and tests of insulation compounds. The label on the front cover is marked "Francis Jehl" and "1880." An index has been pasted onto the inside front cover. The book contains 284 numbered pages.

Blank pages not filmed: 202-203, 216-221, 224-229, 248-249, 260-261, 264-269, 274-275.

Index

Exp. 1.

Made a very dilute solution of [illegible] acid.

[illegible] Bichro[illegible] paper [illegible] the being [illegible] [illegible]

went to look at it, I found that it was broken how I dont know, I noticed that one of the clamps was black. I put a new Carbon in again

Index

July 5 1880

Exp. 1.

Made a very diluted solution of [illegible] acid. got six [illegible] of Bichromate battery. made to a [illegible] in clamps and put the battery on to it, it being [illegible] put in the solution.

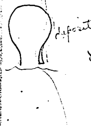
In the evening I went to look at it I found that it was broken how I dont know, I noticed that one of the clamps was black. I put a new carbon in again

[illegible]

In the morning (July 6)
I look at it again and
there was a thin deposit
[illegible] on one of the clamps
(the zinc end).

Ex 2.

Made a diluted solution
of Copper Sulphate +
took a carbon in clamps
and put it into it, and
put one cup of Daniells
on it. let it worked
all night and in the
morning there was a
deposit on the carbon



as shown in the
figure.

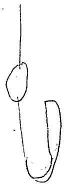
SX4 July 6. 1880

Had some good and clean mercury which I cleaned the day before by passing it through some diluted nitric acid and the mercury passing through (in a spray) I had a special pump made that could be sealed off easily with a special lamp (the fall tube from the gauge so as to have the lamp and gauge in one place, and to then to watch and see how much the gauge would fall, while the

lamp was burning.

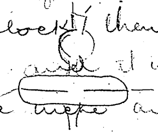
I put in one of the ~~reg~~ lamps, specify as the "monkey grass" lamp just fifteen minutes past one and at twenty minutes to three it was ready to be sealed from the fall tube called Mr Edison and on coming back found the lamp busted. I then immediately put on another lamp, this time one of the regular and at five it was ready to be sealed off from the fall tube. after being sealed it was

watched by Mr Edison And myself and the vacuum fell from one which was very good before started being about an inch from the top Got one which was very bad being way down in the whole tube of the gauge.



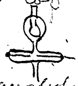
N 5 July 7 1880

Got a pump made which could only be sealed off from the gauge as before, the lamp being sealed direct (this time) to the pump, (no stopper used) commenced half past eleven, ~~twelve~~, heated the lamp at about five minutes to twelve, kept pump running all through noon, got a very high vacuum, (very good) after dinner heated it up again and

at about two oclock
we sealed it off.
did not all this while
[illegible] a pipe for fear
of air getting up. then
we left it till four
oclock then we tried

it and it was about
one inch and a half
from the top tested it
again at six oclock
and it went down
about threequarters of an
inch.

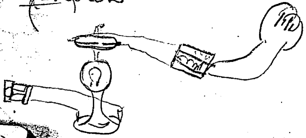
~~Lathe Haden~~

~~Had a pump made~~
~~them of~~.

Had a lamp made in
the afternoon by Bohm which
was on top of a spark gauge
like this  In the evening
we exhausted it, commencing
at eight and ending
at ten. The lamp was
heated for about an hour

July 8 1880

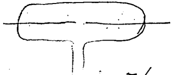
had the induction coil fixed up. two use in multiple arc. gave a spark about two and a half in in length. Then put it on the lamp (or rather on the spark coil above the lamp) being fixed as shown below



then I moved the two points to-gether of the induction coil to see which was the smallest resistance the gauge or the air. The gauge seemed to be it, showing that the vacuum was not so very good, because it allowed the current to pass through it, it gave that blue (~~lt~~ sky blue) phosphorescence on the outside end of the induction coil, and on the other end it was very slight ~~green~~ green. (just at the end)

~~Bast~~

1 Paper
2 Palm Leaf
3 Rice Straw
4 Bamboo



7/1000

(Test at the armature that was crossed the day before yesterday with the wire that is ~~wound~~ wound around on it. It tested all right, [illegible] Resistance being the res.)

Got another pump put up at about half past eleven and put a gauge on to it, and at twelve sealed it off; then put it on the spark coil, and showed a poor vacuum; (it must have had a crack in it)

Put a Bast fiber 6 in long, 12 by 12 5/64 on the end, put it on at 20 m past one oclock about three after they were through using the Railroad I put the current on, it had a bad spot on it near the clamps,

3 | 64
32

32

6290
6280
12570
3 | 7770
12
2 wat | 497
2

Test of Lamp

Bass fiber 6 in long

Res cold Δ 310

20 cells = 32 Def.

C. ~~17~~22

E M F. 217.

Def on Lamp ~~[illegible]~~ 70

Def on Res 70.2 ohm ~~170~~ 180

16C

~~Def on Lamp~~ 65 175

Def on R 175

Em F. 206

3) 206 26
·682
23
136

70.2

175 ! 65 !! x ! 70.2 137

175
70.2
350

65

1325

Res 204R 65) 1312.8 50 (204R
130
0265
260

137 4
137

137 4
137
959 2
411
137
18769 22 2
4413
56307 3
5076
75076
8314667

204) 831466.4 (4
2886

Res. 210
204) 831666.
816
510
1566
1428
1386
1224

(4076. / 33000
8
32608
8
8

4076
204 2
16204
152

304

4076
204 2
16304
152
831504

184 ! 70 : x ! 70.2

184 2
70.2
368 5
1288
70

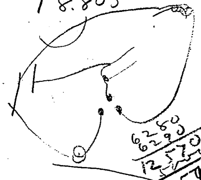
316

70) 1291.6.8 (184
591

6290
6330
12620
+ 2185
18.805

17

1600
5000
4000
2000
7000
8131 00
162
16



700
500
600
3100
3200
6300

6280
6290
12570
17590

Put on at K,12 at
44 C. Def 242 - 162

70/14000

14000
12620
1380

17570
175.

12620
1400
24020
7050

1000000
460000

Lamp was exhausted 2230 little night. while heating & there seemed to be a little blue. Res while cold 2320 ohms when at 16 C. it was 1470 ohms

Def on Ell 7. 3/180

20 cell = 32

147 / 120 / 120 / 2400

60
120 V
10000

147 / 120 / 120 / 624

120
120
2400
14400

10000

1580
1323
157

147 / 588

43200
57600
57600

1323 / 147) 679200.0 (43
588
499
441
1580

105

14000
12620
1380

6280
6290
6250
6250
9000
900
34970 (174

6280
6290
6250
6250
25070
4400
29470

27) 34970 (174

20) 29470 (147

2 2

147) 637920 (4339.

4990
441
582
441
1410
1323

was put on at 11.20
at 44 C stop at twelve
was put again at 44 C
at 8.57 went up at
nine oclock.

July 90 1880

Large Carbon
Lamp 1211 in Lead Glass,
commenced at 9,40
and Stopped at twelve
had a pretty good
vacuum.

Tested Carbon Cold
it was 275 ohms.

6

6290
6280
6260
6250
6290
3500

207) 34879 (174
148
140
8627
69

212
207
419
209

3|207
69

1½

Cold 275 ohms
when hot at 16 C
it was 174 ohms.

Ein 7. 207 - ~~212~~
1380

138
138
1104
414
138
19044
4413
7132
76176
76176

174) 843649.2 (4848. ft lbs
696
1476
1392
844
696
1489
1396
93

4848 | 33000 (

put at 44 C at 8 o'clock
it was slightly blue
in the glass, went up
at 3.05

7010

200 14020 6290

2 |14020
7010

Bamboo 1248

was put on at 3.20
and at six took it off
after supper I wanted
to test it and I ~~saw~~
it was broken at the
clamps.

July 10 1880

No. 1249 Palmetto fiber

had it exhausted in the morning. Res when cold 483 ohms,

152 U^2
152

304
760
152

23104
44.3

69312
92416
92416

300)1023597.2(3411 3411 ft lb
900
1235
1200
350
300
507
300
207

3411) 33000 (9.6 per horse
30699
2301
3

~~No. 1253. Bamboo of the Tip of a fan~~

At 17 C. E.M.F. 227-228

Def on Res. 253 Res. 70.2
Def on Lamp. 59 300 hot

253 : 59 :: X : 70.2

253
70.2
506
1771

59) 17760.6 (300.
177
60

3/227
75

3/227
76
2
152

2/228
76

No 1253 Bamboo from
the top of a fair wind

20 ft 65

Res when C.r.l. 188 R

17 C : E.M 7.298

8.6

3

99) 434184. (43
396
381

114) 434184. (3808
342
972
912
0984
912
72

6290
6280
6260
4100

200) 22938 (114 hot
200
293
200
93
80

3 | 298
99

99
99
891
891
9801
443
29403
39204
3910204

$\frac{v^2 \times 44.3}{R}$

3808 998 7
3046479

99) 434184.3 (433
396
381
297

38081) 33000 (8.6648
30464
25360
656
792
564

1259. Paper

busted on the pump. there was a very bad spot near one of the clamps.

Sunday July 11 1880

Went and made the def of my twenty cells = 216 def and then left it, to renew them again

---

When renewed it gave 241 - 244.

10/240 (24) O

July 12 1880

Another test of Bamboo Lamp. No. 1253 burning at 16 c/p

Put on at 3 a.m. 3 40

2 lbs.

289
310
2|599
2|299
99

6290
3
20|22630|113
204
226
63
113|434184|3842 2/3 ft lbs
339
951
904
478
452
264
226

3842|30000|8.5 ft
22640
210

put on at 10.10 a.m. at 44 C. $15 d.

after being ~~down~~ burning 30 m I took off the C to hail the lamp on the pump. put on again at 44 C at 10.48 stop again at 11.28. put it on again at 11.30 it broke at 11.35

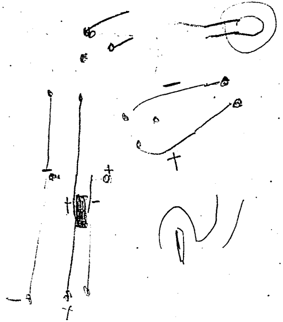
30 m
45
75

12
28
5
45

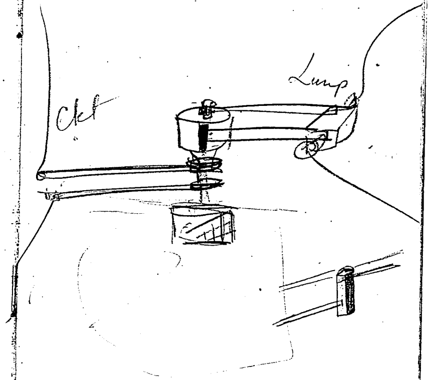
have burned a total of 75 m at 44 C.

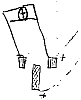
July 12 1880

1250 Palmetto ;
very bad spot look and
scaled it off.



Corning glass, lamps with
Spark gauge, No 1251





$\frac{1}{14}\ \frac{1}{16}$

77/910

$$\mathcal{E} = \frac{Q}{R}$$

$$R = C\mathcal{E}$$

$$\cancel{\mathcal{E} = \frac{e}{R}}$$

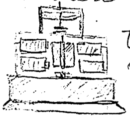
$$e = \frac{\mathcal{E}}{R}$$

$$eR = \mathcal{E}$$

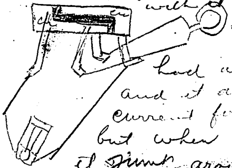
$$R = \frac{\mathcal{E}}{e}$$

July 17 18[illegible].

Took a little motor (electric motor) the three armature one with four [illegible]. two on one side and ~~th~~ two on the other, something as shown in the figure



Then made an armature so that the current could be reversed, something as show in the figure below. And had it on the motor so that it would revolve with the Jank



had a lamp on and it alternated the current first straight, but when the lamp busted it jump across the armature and burned it a little

.1237

Bass clamped very slightly

$$\begin{array}{r} 273 \\ 1.3 \\ \hline 819 \\ 273 \\ \hline 49 \end{array} \qquad \begin{array}{r} 273 \\ 1.366 \\ \hline 1638 \\ 1638 \\ 819 \\ 273 \\ \hline \end{array}$$

373) 372.918 (1

$$V = \frac{273 \times v}{273 + t}$$

$$V = \frac{273 v}{273 + t}$$

$$V = \frac{273 \times v}{273 + t}$$

$$V = \frac{R v}{760}$$ ~~380~~ $\frac{380}{760}$ $\frac{20}{60}$ 60

$\frac{200}{14}$

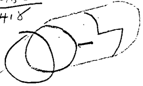
100 : 108 :: 60 : x

1080

100) 6450

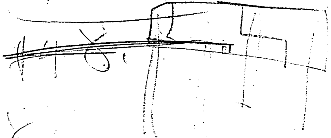
6418

62



14880

100 : 108



St Francis Beauce

Francis Beauce

St-François Beauce

Forerunner Franklin

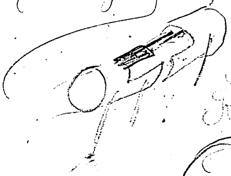
Boston Review

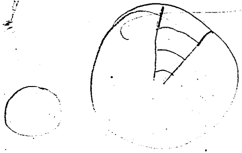
Fortnightly

Review

Review

Review





July 26 1880

Lamp that was put in Kerosene
Lamp put up at 9.37
at 120 C and tested at
10.1
~~8~~ ohms when hot at
this candle power

254
250
2)504
20)252(12.5

1,08 64

4)254
63

4)252
63

100 : 1.08 :: 64 : X

108
64
432
648
100)69.12
69.1

Testing Standard cells. Aug 18 1880

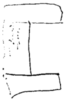
Cells	R	L
Box 1	254 def	250.5 def
2	254	250
3	251 / 253	247 / 250
4	244 / 254	240 / 250
5	253	248 / 250

~~1.08 : 100 :: x : 83~~

~~100 : 1.08 : 3~~

108
3
324

100 : 108 :



Aug 18

Testing that small piece of Railroad track.

Res of Wire 3.85 ~~ohms 3.85~~

Res of the track 4250 ohms

Tested it with bridge and with Thompsons Quad Res Gal..

Testing the 25 wire cable Tested 13.9 ohms there Must be a cross somewhere

10

3)130

43

2

86

33)/130 (4

2

21.6

8.6

Aug 19 188

$10.\frac{2}{3}$ 3)16

70)14000
2000

$10.\frac{2}{3}$ 50)200

32 4

21.6
4
86.4 2

3)42
14

420

64)270.0(4.22
256
140
128

21.6
4.2
432
864
90.72

1600
3200
6300

12600
1400

70)14000
2000

1200
14000
12600
1400

70)14000(200
140

Aug. 19 1880

Lamp No 1453

8 x 16

Res. Cold 329 ohms

$10.\frac{2}{3}$ C

Em R. 208 L. 208

37.660 Res.
5600
200

143160
215 ohms

Em R 243 ~~R 239~~ L. 239

32 C

20 cell 32 R
" " " 33 Y

2)65
33

37.660
100
200

Aug 19

33)2080(6.3
198
100

21.6
6.3
648
1296
136.08

136 V

10.66 C

10.66 C 136 V
136
816
408
136
18496
443
55488
73984
73984

ohms
211) 819372.8 (3883. ft lbs
633
1863
1688
1757
1688
692
633

200) 43160 (210. ohms
400
316
200
160

10.66
8.4
4264
8528
89.544 C per H.P.

3883) 33000.0 (8.4 H.P.
31064
19360

10.66 C
Res 210 ohms
ft lbs 3883,
per H.P 8.4

243
239
2182
33) 241 (7.3
231
100

21.6 all
7.3
648
1512
157.68

157 V

157
157
1099
785
157
24649
443
73947
98596
98596
188) 651950.7 (3467 ft lbs
564
879
752
1275
1128
1470
1316
154

3467) 33000 (

37.660
200) 37760 (188 Res
200
1776
1600
1760

32 C

157
157
1099
157
157
24649
443
73947

188)109195 (5808. ft lbs
940
1519
1504
1550
1504
46

5808)33000 (5.6 ft lbs
29040
39600
34846
4752

x

$\frac{x-10}{10} =$

$\frac{x}{4} - 10 = \frac{x-10}{10}$

~~$x = 40$~~

$10x - 400 = 4x - 40$

$6x = 360$

$x = 60$

$\frac{x-20}{12}$

$\frac{x-20}{12} = \frac{x}{6} - 20$

$x - 20 = 2x - 40$

5808 ft lbs
Res 188 ohms
5.6 Pot. P.

16
8
128

144 :: 165
165
720
864
144

128)23760 (184 ohms
128
1096
1024
720

223)1000 (

ans 19 meter 45 Res

no	.107 has	R 45
1	.11	L 43
2	.02 .03	R 40 L 182
3	.0219 .03	R 48 L 179
4	.02 .03	R 55 L 168
5	.0284 .03	R 85 L 150

235)1000 (.4

Aug 20 1880 58.2

Meter Res.

No 1 Res .106

R 45
L 43
88

45
88)1.00 (1.4
88
220
180
40

4.5
1.4
180
45
63.0

Diameter
.017
.011
.011
.011
.011

Meter Shunts German Silver

No of Band	Res	Di	Lgth mm	German Silver
1	~~.0~~160	.011	583 mm	6 mm
2	.0216	.011	437 mm	25 mm
3	.0219	.011	436 mm	25.5 mm
4	.0222	.011	608 mm	35 mm
5	.0234	.010	610 mm	35 mm

~~No 1 Res .106 Di .011 Length 583 mm~~
~~2 .0216 .11 " 437~~
~~3 .0219 .11 " 436 "~~
~~4 .0222 .11 " 608~~
~~5 " .0234 .10 " 610 mm~~

125
125
625
250
125
15625
443
46875
62500
62500
195) 6921875 (3549 . ft
1071
975
968
780
1887
1750
132

3549) 33000 (9.0
31941
1059

3549
8
28392

3549
9
941

3549
9
941

Aug 20 188

1457. 8+16 (from George)

Cold 307 ohms

10.66 C

E M 7,1978
190 R

R 37,650
1.500
200
195 ohms

37,650
1.500
200) 39150 (195
1915
1800
1110
1000

31
36
2) 67
33

1250

197
190
2) 387
33) 193 (5.8
165
280
264
16

216
58
1728
1080
12528

Res cold 307
10.66 C
Res 195 ohms
1250
ft lbs 3549
9. H.P

110 110 110
110 110
0 000
110
110
12100 159
110 159
110 11
1100
110
12100
443

26300
48400
48400

159) 435030.0 (2736.
318
1170
1113
477
477
960
954

2736) 330000 (12.112
2736
5640
5472

Cold Res 262
Hot 159 ohms
1100
2736 watts
12 H.P.

Aug 20 1880

Lamp. 1452

(note from Batchbook) Bamboo carb. by Van Cleve in the old factory [marked] 8/1000 by 16/1000 Aug 18 1880. german glass, edge ways

~~10.66 candles~~

Cold 262 ohms

E.M.F. L. 173
R 16.6

173
166
2) 339
33) 169 (5.1
165
40

Res
~~6290~~

37650
6290
31360

37.650 − 6290 + 500

200

31360
500
200) 31860 (159
200
1186
1000
1860

Batteries 159 ohms
R 31
L ~~36~~ 36
67

33

1100
21.6
511
216
1080
11016

339	2.5302
67	8.1739
21.6	1.3345
	2.0386
	2,0386
109.3 Volts	11.6464
159	7.7986
	3.5222

3300

10 per H.P.

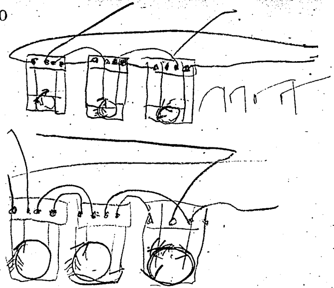
Aug 21 1880

Tested some of the cables
Found one wire [illegible] 25 and 18 wire
section [illegible] tested
at first [illegible] found the [illegible]
to be a lamp post dead cross,
after this [illegible]
[illegible] 2145 ohms [illegible] 1085
This cable 10 [illegible] wrapped [illegible]
with muslin [illegible] [illegible]
with muslin covered with [illegible]
Coal tar ~~bo~~[illegible] with crude coal
tar, [illegible]

Aug 23 1880

Carmans Circuit 25. 18. 11
and turnpike section [illegible]
[illegible] between wires 15 ohms

Ground 37 ohms both sides



Aug 23

Fixed up the machines in the dynamo room, three batteries in series.

Also made some testing batteries, zincs + carbons.

Aug 25 1875

The machines sparked very bad last night (aug 24) In the morning I tested all the lines, + found that the cross was in the Locomotive line Res between the wires I cut was 2.4 ohms

Aug 26 1880

(Land showing yesterday) Germans circuit 25 + 18 wire section circuit between wires 3,000 ohms ground 1250 + 1435 ohms

aug 26 25.18.11 + Turnpike section in circuit.
Between wires 13.6 ohms
Ground 37.7 + 37.5

Aug 26 1880

31
32
263
31

Lamps with nickel clamp
12 by 12.

No 1463. 1464. 1465 —

Battery $\frac{31}{32}$ / 2 = 31.5

Dif. 260

21.6
8.4
864
1728
181.44

31.5) 2656 (8.4
2520
1300
1260

1808.

No 1463. Aug 26 188

Put this on Photometer
at 50 candles one clamp shews a blue flame inside its loop as if it were caused by joint of Platinum and nickel also that clamp blackened ~~slightly~~
at 30 candles same only weaker
at 16 candles it did not show it
Other clamp clean and bright.
E. M. F. Dif 260

32
16
48

Lamp 1464 = Aug 26 188

On Photometer
at 48 candles showed a little blue on same clamp filling only space x like 1463.

at 18 candles it showed more and on outside of clamps also — put on at 48 candles again and it showed blue very strong —

Lamp 1464
On Photometer
At ~~48~~ 7 candles showed no blue
at 21 candles showed blue outside and inside clamp
at 48 very strong blue

All the lamps were put on at 48 at 12.55. 1464. Lamp broke at 4.10

Aug 26 1880

31
32
263
31

Lamp po with nickel clamp
12 by 12.

On 1463. 1464. 1465 —

Battery $\frac{31}{32}$ / 2 = 31.5

Res. 265

21.6
8.4
864
1728
181.44

31.5 (2650 (8.4
2520
1300
1260

180V.

No 1463. Aug 26 188

Put this on Photometer
at 50 candles one clamp shews a blue flame inside its loop as if it were caused by joint of Platinum and nickel also that clamp blackened ~~slightly~~
at 30 candles same only weaker
at 16 candles it did not show it

Other clamp clean and bright.
E. M. F. Bat 260

32
16
48

Lamp 1464 = Aug 26 188

On Photometer
at 48 candles showed a little blue on same clamp filling only space x like 1463.

at 18 candles it showed more and on outside of clamp also — put on at 48 candles again and it showed blue very strong —

Lamp 1464
On Photometer
At ~~48~~ 7 candles showed no blue
at 21 candles showed blue outside and inside clamp
at 48 very strong blue
All the lamps were put on at 48 at 12.55. 1464 Lamp broke at 4.10

Aug 26 1880

Test of Standard battery. $CuSO_4$ + Zn

Box 1	L 236.5	,	R 239
" 2	L 235.	,	R 237.5
" 3	L 237	,	R 239
" 4	L 238	,	R 237
" 5	L 237	,	R 239

Aug [illegible]

Tested Lamp 1484 [illegible] [illegible] good, the batteries [illegible]

169) 303 (2

150) 245 (1.6 242

284
281
2)565
282

150) 282 (1

21.6
1.8
1728
216
3888

Comparing Bi-Chromate battery (a single Fuller) with the standard battery

Standard cells	R Df	L Df	Fuller cells	R Df	L Df
1	169	168.5	1	319.5	322.5
4	87	88	4	163	164
4	169	158	4	297.5	294
~~4~~			4 cells	303	300
					300
20	150	150	20C	284	281

284
181
3) 3.6.5
1.88
1504

1.88
1.08
1504
188
2.020

21.6
1.08
1728
216

21.6
1.8
1728
216

21.6
1.8
1728
216
38.88

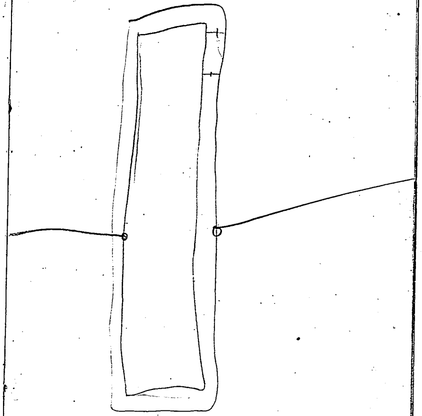
Aug 27 1880
Small [illegible] R.R.
Res. ~~[illegible]~~ 8390 [illegible]

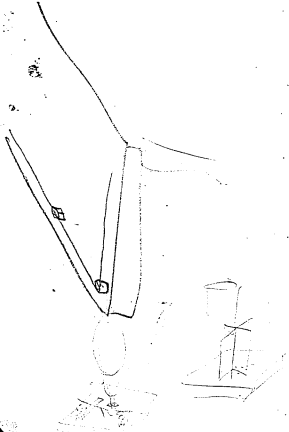
Aug 27 180
Gum Benzoin
Oil spruce
oxalic Acid

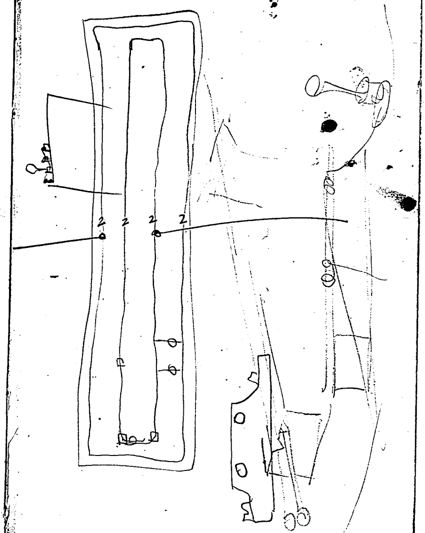
Tungstate Ammonia
Gum Benzuela
Oil Spruce
[illegible]

Gum Amber
Benzuela Copal
Aniline Oil
Oil Succin
Carbolic Acid
creosote.

Benzuella Copal
Gum Camphor
oil spruce






2
2
2
2

Aug 28 1880

Ex 1.

Put a lamp in the bridge and balanced it, then jared it to see if it would alter its resistance, but the gal did not move also tried a little heat with a lamp but did not act on it, had five cells

Aug 29 1880

The last one made of the spiders showed a poor vacuum the spark did not jump outside there was a light pink phosphorescence and the glass ~~had~~ a green phosphorescence

2 one of the spiders made some time ago, its phosphorescence was much brighter, showed a poorer vacuum than the one above

No 3 showed a poor vacuum

Aug 31 Insulation test

Test of cable made by Howell. was put in water and tested 54 ohms

another coil of wire without insulation ~~tested~~ 127 ohm

2 R

1 Insulated cable I lifted the Fe plate up and it went up to 180 ohms.

Aug 31 1880

Test the bare wire by R Mellotts:

$R'' = 1001$
$R = 1000$
D of 226 + R'' + R
$S = 100$ ohm

Cable Insulated

R'' 500
R 500
Def of 352 with R'' + R

S 120

~~325~~
~~300~~ 339 Def

77 ohm plate down

September 1 1880

Cable 3 layers Tar ~~Rubber Cloth~~

Aug 31 1880 51000

Sept 1 " 4850
Sept 2 3200

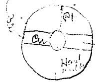
Sept 2 1880

~~Made a~~
~~Got a thin piece of hard Rubber & put a hole in The center. ~~~~

2-8.2
2 3 0

September 2 1880

Made an apparatus as follows, to see if any thermo current is [illegible]



set up.

took a diluted solution of [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] put a drop of Soda on one side and a drop [illegible] [illegible] the other [illegible]. This connected to [illegible] [illegible] [illegible] [illegible] [illegible] of 40, and then gradually fell —

I then concentrated light upon the the small piece which had the [illegible] [illegible] [illegible]

no difference, the spot of light went gradually down [illegible] before, [illegible] no [illegible].

—

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] with two Daniell cell [illegible] a def of about 45°.

Sept 2 1880

Cable no 4 3" thick [illegible] Each [illegible] with [illegible] cone 2 oz. Res 120 ohms.

2 M.M. 20 Cages September

Sept 2 1880

Some of Phillips cotton insulated paraffin wire. Insulation Resistance 36,000 ohms.

69)36680(

3810 + 34.5 / 34.5

3810 + 6900 / 6900

3884 + 74

74)3884(52.4

Kent Test | Sept 3 1880

Res of H.R.G. 3810 ohms

Con { Def on 1 cell on Condenser without Shunt 69 - 69

Gal { Def on Gal of 1 cell. 351 - 355
Res of Shunt 6.900 ohm

{ Def on 40 cells. 350 - 355
Res on Shunt. 34.5

Con { Def on 40 = 69. 71
Res of Shunt = 74 ohms

1 cell + 10000 ohms. Def 351 - 355
Res of Shunt 427. ohm

Kent wire Def with 40 cells
50. 50

Insulation 55320400.

No. 2
September 3 1880

3 layers of Rubber each & 3 Cai[illegible] & Tar. 3200 ohms

Sep 4	2630 ohms
6	1500
8	2400

2 thick muslin each served with hot linseed oil

Sept 3	470 ohms.
Sep 4	140 ohms
Sept 6	110 ohms

 Cable No 6 Sept 3

" muslin wound on cable
then served with parrafin
thin rubber cloth, then
cloth again with parrafin "

Sept 3 1200 ohms

Sept 4 171 ohms

Sep 6 120 ohms.

" Cable No 7

3 thick muslin each
served with coal tar
treated with [illegible] "

Sept 4 120 ohms.

Cable no 8 Sept 4

167

Three thickness rubber

17 470 cloth with rubber

470 cement between

1st and 2d + 2d + 3d

layers:

Sept 4 Rs when first put in 12500

th about a half an hour

afterward it went down

to 7000. (The water having

soaked in by this time a

little) ~~184~~ 130 ohms

Sep 6

Cable no 9 Sept 4

3 thick rubber cloth,

with parrafine between

1st + 2d and between

2d + 3d layers.

Sept 4 9000 when first put in

the water, about a hour

afterwards it was reduced

to 3500

Sept 6 120 ohms

Sept. 4

Res of one (first) Faller cell
2.12 ohms

~~Phillipps~~
Phillips went down
from 36000 on Sept
2 to about 250 on
Sept 4 1880

Sept 6 1880

Carbons for Rowland

No 1 Paper with 2 volts on for
10 minutes in a diluted
solution of C.P. $CuSO_4$

Sept 7 1880

Galvanometer wire 15.5 ohms

Long Carbon 9.40 on 8.0
took it out at 10. was plated
all over.

Sept 7	79.000 ohms.

No 10 Sept 7 ~~1880~~

Sept 7	2990-00 Ohms
Sept 8	1400 . ohms

Cable No 12

Sept 7	26000.
Sept 8	1000 ohms

one length of 100 ft of Bare wire submerged in water.

~~Res~~ Date	Res	Date						
	127.							

Cable No 1

One Thickness Rubber Cloth (white) spirals overlapping about 1/3 and tarred with stiff coal tar,

Res. 54 ohms. plates lower down in the water

Cable No 2.
3 layers of Rubber cloth and
3 layers of Tar.

~~Sept~~ aug	Res	Sept	
		11	2400
31	57000	~~Sept~~ 13	1910
Sept 1	4850	14	2000
2	3200	15	2000
4	2480	16	1800
6	1500		
8	2400		
9	2400		

(No 3) Two Thickness of white Rubber cloth wound in opposite directions
Res 77 ohms.

No 4
3 thickness of cloth.
Tared with boiled coal
tar. Res 120 ohms
Sept 200 Sept 10 200 ohms taken out

No 5 Two thickness cloth each
served with hot linseed
oil. Res Taken out

Sept	Res
3.	470
4.	140
6	110
9	170.
10	170

No 6 Cloth wound on Cable
served with parrafin, Then
Rubber cloth (Black)
Cloth again with parrafin

taken out

Sept	ohms
3	1200k
4	171
6	120
9	140
10	130

7 3 Thickness cloth, served with coal tar treated with quicklime

Sept 4 120 ohms taken out

---

8. Bare wire rubbed with dry hard parrafin
Thin Rubber cloth Blk covered with black rubber cement
Then rubber cloth, Then cement.
Then rubber cloth, smoothed down with hand paper.

4 Sept 12500 then went down to
7000

Sept 10 209
Sept 17 210

Sept 6 130
" 9 210

---

9 Bare wire rubbed with parrafin,
Rubber cloth
Then Cold & hot parrafin
Then rubber cloth and parrafin
and rubber cloth with more parrafin (Cold)

Sept 4 9000 ~~ohs~~ went down ~~to~~ ~~there~~ after being in the water for an hour 3000

" 6 120 ohms.

" 9 120 ohms.

10 120 ohms

Took the cable No 10 and had the ~~the set~~ coils lifted up and Measured it evertime.

Cable. Sept 11.

1	320 ohms
1 0	324 " "
2	390 " "
3	500 " "
4	550 " "
5	5570 " "
6	580 " "
7	580 " "
8	540 " "
9	540 " "
10	544 " "
11	570 " "
12	570 " "
	630 " "
	750 " "
	970 " "
	" " " "
	1000
	1200 " "
	1400
	1500

10 Rubber cement on bare wire thin Rubber cloth, muslin, Compound 3#, rubber cloth rubber cement, rubber cloth Rubber cement, ~~rubber cloth~~ ~~rubber cement~~ dusted with Chalk.

Sept 7	299000
" 8	1400
" 9	500
10	450

No 11 Rubber cement on bare wire 11 thick
Rubber cloth
muslin
compound #1
Rubber cloth
" cement
cloth
cement
Dusted with chalk

Sept 7	79000
" 9	240 ohms
10	215 ohms

$$cx + cr + cy = c_1p + c_1r + c_1g$$

$$cx = -cr + cy + c_1p + c_1r + c_1g$$

$$c(R + r + y) = c_1(p + r + y)$$

$$y = \frac{c_1(\ )}{c}$$

$$R = \frac{a_1^0}{a^0}(p + y) - y$$

$$R = \frac{a_1^0\, a_1^0 p - a_1^0 y}{a^0} - y$$

$$a^0 R = a_1^0 p + a_1^0 y - a_1^0 y$$

$$a^0 y + a_1^0 + y = \frac{-a^0 R + a_1^0 p}{a_1^0 + a^0} = a$$

100000 10000 .0 1000

12 Marlin on bare wire
Compound # 2
Muslin soaked in linseed
Compound 2 # thinned with Cotton
seed oil. Muslin
Rubber cloth
" " cement
Rubber cloth "

Sep 7, 26000
" 8, 1000 ohm
" 9, 740 ohms
" 10 540 "
" 13 300

No 13. 5-6

20 5 wire covered with Marlin
Then boiled in compound
TB 3 Then Rubber Cloth

14 7 strands wound with
marline.

15 Muslin
Refuse Compound
Muslin
Refuse Compound

Sept 13 Res 140 ohms

16 White rubber cloth 3 layers
Boiled pine tar 2 servings
Made to compare with #2

Sep 13
176000 ohms

85000
Sept 14 85000 ohms
" 15 30000 ohms
" 16 12500 ohms

17

18

19

Rubber cloth
Compound # 7
Rubber cloth
Compound 7
Rubber cloth.

Compound 7
Oxized. Linseed oil Pine tar
+ asphaltum
+ paraffine

Sept 10 1880

B $32^D - 32$ .55 magnet 182^D ÷ $3)183$ / 60 / 12^D

machine 11

B. 32 - 31.5 89.0 ÷ 80

B = 64 63.5 = 179^D ÷ 179.

Machine 10

B 64 - 62.5 176^D ÷ 177 5.9

Machine 4

B 64 - 64 163 - 160 5^4

55 120 V.

4
10
11

$32)182(5.6$ / 160 / 220 / 192

$21.6 \times 5.6 = 1296 / 1080 / 120.96$ 3

$21.6 \times 2.8 = 1728 / 216 / 3888$

$64)179(2.8$ / 128 / 510 / 512

$\frac{v^2}{R} = 44.3$

Machine No. 4 Heated more than any other

Marked thin

6¼ X 9

The resistance of armature .14
Magnet 1.7 Ohms
Lines all right
No ... [illegible]
Also magnet ... [illegible]

Magnets

.55 mail [illegible] β = ~~[illegible]~~

β = 2[illegible] [illegible] [illegible]

Leading wire .06

1	.14	19	14
2	.15	20	14
3	.14	21	14
4	14	22	14
5	14	[illegible]	14
6	14	24	14
7	14	25	14
8	.19	26	17
9	14	27	14
10	14	28	36
11	14	[illegible]	14
12	14	30	14
13	14	[illegible]	14
14	14	[illegible]	14
15	14	[illegible]	[illegible]
16	14	34	[illegible]
17	14	[illegible]	14
18	14	[illegible]7	14
		[illegible]8	14

.042) 9.83 (234.4

1764

98448

2344.

9.83

.042
.042
84
168
.001764

.77
.32
9.45

3.2
10.0

.140
.040

50) 800 (.16

546111.
4368888
546111
9829998

.042
.042
84
168
1844

.042
.042
84
168
.001764

5461.
.0018
43688
5461
9829.8

9.83

.0018) 9.83 (5461.

9.83

testing The per cent of cu in The wire. for The armature.

Length 30 ft Temp. 77° Fr

Diameter .042

" " .0415
.041
.0415
.041
.042
.0415
.0415
.042

Res. .185 ohms.

Length 30 ft Temp 77° Fr

Weight in grams 108.6 grams f 3 feet

108.60
1086.0 1086 in 30 ft

.0018) 9.83 (

.003824
19120
7648
.00099800

5461.
30
163830
1474470
163830
17857470

4/9.83

1764) 9.8300 (.0057

.01798850

.018 : .185 : 400

.18) .0

2.367) 2.2065 (.96

1764) 22.4410 (.18

.185) 18.00 (.97

$\frac{18}{100}$. $\frac{18.5}{100}$ = $\frac{18}{100}$ $\frac{100}{18.5}$) 1800 (

3/108.6 .18

36.2

36.2 grains in one foot.

30) .180 (.006

1 foot Res .006 weight 36.2

.2367) .21850 (.9

.2367) .21060 (.9

Lesson No 19 Cable

Def on one cell L ~~299~~ 300. Res of S 1260
R 305

302
302
4.09
2718
1208
1235.18

1260) 5168 (4.09
5040
1200
1124

3900
44.4
3944.4

444) 3944.4 (88.
3552
3924

2416
2416
26576

15518) 26567.00 (17.
15518
110490
108626
18640

302
27
2114
604
8154

15518
9662
15518
124144

15518
7
108626

15518
17
108626
15518
263806

1235.18) 26567.00 (21.1
24703
1867
1235
2320

26567 (17
15518
11049
10862
217

3900
148
148) 4048 (2
4048
60

148) 4048 (27
2960
1088
1036

3.810 ohms

Def one cell L 300 R 305 Res of S 1260 ohms
" 20 " L 300 R 305 Res of S 444.4 ohms
(Def of one cell through 10000 ohms L 300 R.305
(Res of S 148 ohms.

Def on cable
Res shunt 1030 300 . 307 Def

S 974 300 : 307
S – 940 Gal R 3900

1235.18 ~~15518~~ Def of one cell without S
26567 " " " " " " "

21.1 times

8154 through Gal with all S
21.1
8154
8154
16308
172049.4
10000
172049400

Res 1117.138 ohms

3900
950
950)4850(5.1
485
475
100

302
511
15302
154002

1540)1720494000(1.117138
154
180
154
264
154
1109
924
185

1109
1078
214
154
600
462
1380
1232
1480

202.5
203
405.5
135

251.50
40
291.5
145.7   160

2.1303
2.1303
1.6064
7.8356
3.7426   5530

Oct 6 1878

Res	~~31400+~~	no 91
EM7	202.5 − 203	
Res	$\frac{25150 + 4000}{200}$	
e	48	
But	32 − 32	
EM7	168 −	
Res	$\frac{25150 + 5900}{200}$	
e	16	

237
236
473
158

376.5
5
381
190

2.1987
2.1987
1.4464
1.7212
3.7650

5820

3765 0
500
20) 3815 0 (190 ohm
180

4 m 7	237 – 236 no 98
C	48
Res	$\frac{37650 + 500}{200}$
	Blue at one of the clamps
8 m 7	217 – 216
Res	$\frac{37650 + 2400}{200}$
C	16

37650
500
20) 481 50 (L9
40
180

$$\begin{array}{r} 215\frac{}{2} \\ 3\overline{)430} \\ 143 \end{array}$$

Emf	215 – 215	no 36
Res	$\frac{31400 + 5000}{200}$	
e	4	
Emf	180 – 182	
Res	$\frac{31400 + 7000}{2000}$	
Res	16	

31400 143 √
5000

200) 26400 (182 R
200
168

E M7	244 – 244	No 17
Res	$\frac{37650 + 2800}{200}$	
C	48	Blue at the Clamp
E. M7	209 – 209	
Res	$\frac{37650 + 5600}{200}$	
C	16	

37650
2800
20/40450 (202R
1620

244
2
3(488
162

Em7	225 – 220 No 43
Ris	$\frac{31400 + 4300}{200}$
C	48 Blue at clamp + [illegible]
E.M7	195 + 197
Res	$\frac{31400 + 6400}{20}$
C	

31400   1500
4300
20)357.00(178 R
20
157
140
170   225
3)450
150

E.M.T	204 - 203	no 47
Res	$\frac{31400 + 1800}{2000}$	
C	45	
E.M.T	173 - 172	
Res	$\frac{31400 + 3500}{2000}$	
C	16	

204
203
2)407
135

31400
1800
20)3320,0   1355
2
133   166 R
120
128
120

Emt	194 – 194 40
Res	$\frac{25150 + 6100}{200}$
R	48
Emt	164 – 163
Res	$\frac{25150 + 7800}{200}$
R	16

25150
6100
20)31250 (1290 / 156 R
20
113
125

194
3/388
129

240 212

110 675

E.M.F.	240 - 241 No 45
Res	$\frac{37650 + 5300}{200}$
C	4
E.M.F	212 - 212
Res	$\frac{37650 + 7900}{200}$
C	16

37650
5800
20)42950(2147
40
29
20
95

1605
214 R

241
240
2)481
16

EMT 211 − 211 hoj

Rs $\frac{31400 + 400}{200}$

e 48

EMT [illegible]

Rs $\frac{31400 + 5600}{200}$

e 16

31400 1400

400

20)31800 159 R.

20

118

100

180 1422

180 140

Emf	214 – 214	no 75
Rs	$\frac{31400 + 1400}{200}$	
C	48 Blue in clamp.	
E. M. F.	190 – 190	
Rs	$\frac{3100 + 31400}{200}$	
C	16	

31400
1400
20)3284.0 (164 R
20
128
120
80

1426

3|428
142

E.M7	206 – 208 Mo5
Res	$\frac{31400 + 1800}{200}$
e	48
E.M7	175 – 177
Res	$\frac{31400 + 3700}{200}$
e	16

31400
1800
2) 33200 (166 R
132
120
120

1385

206
205
3)414
138

[illegible]
173
164
212
[illegible]
[illegible]
176
[illegible]
8)[illegible]
186
6
930
1302
1116
125550

225
204
[illegible]
[illegible]
211
[illegible]
[illegible]
8)1723
215
.675

E.M.F. 229 – 230 No 92
Res $\frac{37650 + 1600}{200}$
e 48 Blue at Clamps

E.M.F. 196 – 198
Res $\frac{37650 + 4200}{200}$
e 1.6

37650
1600
20)39250
20
192
180
125

153 ✓
196 Res

229
230
3)459
153

12 25 20

$20y$ 6 $25y$

$5y$

$$\frac{x-20}{12} = \frac{x}{6} - 20$$

20

$x - 20 = 2x - 40$

$x - 2x$ $+20$

$-x = 20$

20

x 25

$$\frac{x-20}{12} = \frac{x}{6} - 20$$

$x - 20 = 2x - 40$

$-x = 20$

$$\frac{x-20}{12} =$$

$$\frac{x-15}{12} =$$

$$\frac{x-20}{12}$$

$$\frac{x}{12} =$$

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

$x - 15 = 2x - 180$

$-x$

15 × 12 = 30 + 15 = 180

180 − 15 = 165

$$\frac{x-20}{12} =$$

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

15 × 12 = 30 + 15 = 180

$x - 15 = 2x - 180$

$-x$

180 − 15 = 165

$$\frac{x-15}{12} = \frac{x}{6}$$

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

$$\frac{x-20}{12} = \frac{x}{6} - 20 - 5$$

$$x - 20 = 2x - 240 - 60$$

$$\frac{x-20}{12} = \frac{x}{6} - 25$$

$$x - 20 = 2x$$

$$\frac{x-20}{12} = \frac{x}{6}$$

$$\frac{x-20}{12} = \frac{x}{6} - 15$$

$$x - 20 = 2x - 180$$

180

$$x - 20 = 2x - 10 - 190$$

$$x =$$

$12 + 60 = x$

5 10

$\frac{1}{5}$

2.

E Mt	212 – 212	No 90
Res	$\frac{31400 + 1400}{200}$	
e	48 Blue at the Clamp	
E. Mt	185 – 185	
Res	$\frac{31400 + 33000}{300}$	
e	16	

31400
1400
20) 32800
20
128
120
80 (424
80
141

1410
164 R

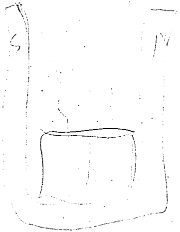
EMF	232 - 235	2089
Res	$\frac{37650 + 4100}{200}$	
C	48	
	Blue at the Clamp	
EMF	215 - 215	
Res	$\frac{37650 + 5700}{200}$	
C	16	

37650
4100 1550
20) 41750 (208 R
40
175

233 232
235
2) 467
155

E.M7	242 – 242	No 93
Res	$\frac{37650 + 5600}{200}$	
e	48 Blue at the clamps	
E.M7	215 – 218	No 93
Res	$\frac{37650 + 7600}{200}$	
C		

37650
5600 161
20) 43250 (216R
242
2) 484
161



E.M7 229-229 no 88

Rs $\dfrac{31400 + 5300}{200}$

C 48

Blue at the clamps

E.M7 203-203

Rs $\dfrac{7500 + 31400}{200}$

C ± 16

31400
5300
20)36700 (183 R
20
167
160
70

1525

229
3)458
152

no 87

E.m.f. 225 - 223

Res $\frac{3000 + 31400}{200}$

C ·48

Blue at the clamp

E.m.f. 195 - 197

Res $\frac{4900 + 31400}{200}$

C 16

31400
3000 1490
20)344.0 (172 R
20
144
140
40

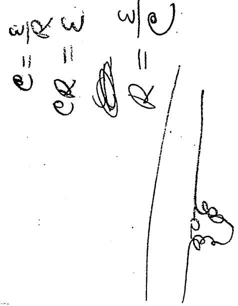
225
223
2)448
149

Em 7	232 - 235	2086
Res	$\frac{31400 + 6000}{200}$	
C	48	
	Blue at the clamp	

Em 7	205 - 205
Res	$\frac{31400 + 8500}{200}$
C	16

31400
6000
20) 37400 (187R
174
1/55.5

232
235
= 467
155



Oct 9 1880

Test of some samples of german Silver wire for the resists coils down the factory

at inches

9' 6.25" of No. .022 = 3 ohms
13 ft 1 inches of No. .042 = 1 ohm.

No. .015. 7 ft 4 in = 5 ohms

Oct 14 1888

1250

Oct 18 1888

Plate $\frac{11}{2}$ marked = 1250 ohms

$\frac{11}{2}$ = 1480 " "

$\frac{1}{2}$ = 1250 = ohms

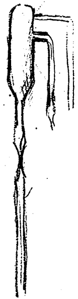
111 = 1250 "

11 = 1240 "

1 = 1350 "

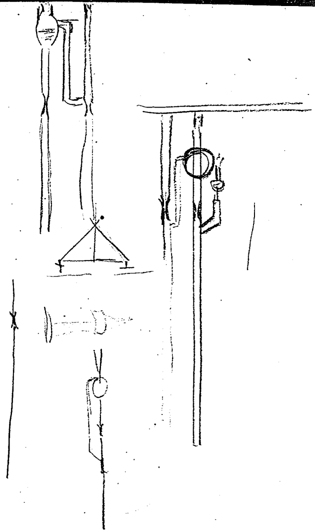
a = 3000 "

dfión



[illegible]

5



Oct 19 1880

tried the experiment of washing out the hydrocarbons

~~Volatalized~~ Find one I loose and tried was to bring the carbon up bright when I had the vapor of Chloroform in I got a thick deposit of Carbon.

~~second~~. first was a carbon tried in the vapor of Bi-sulphide. this Carbon was burning for about ten minutes in the vapor and then I took it out. Carbon seemed to be good.

Second Def. 215

This Carbon was
on the oven for
15 minutes and
gave a good light.
And carbon when
taken out was good

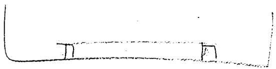
Third. 210

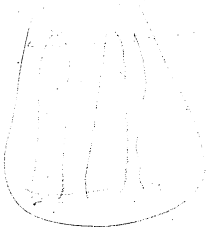
This carbon was burn-
ing on the [illegible] of
the [illegible] about
20 minutes and gave
a good bright light.
I then took it out.

Oct 20 1880

~~Took a Carbon~~
~~Pitch~~
Generated some Chemi[illegible]
[illegible] the part
a Carbon in [illegible]
put a current [illegible]
some compound [illegible]
formed in the Cham[illegible]
that [illegible]
which [illegible]
said.

Oct 21. 1880





Oct 21, 1880

Made an experiment by generating gas from (gasoline) in a flask and then passing it in a mould in which there were some carbons. When finished, we found that they were covered [illegible]

Took a carbon bases and pass gasoline gas through the mould when it was a cherry red, when taken out they did not seemed to be covered. Then took some [illegible] coal and put them in when taken out a very fine [illegible] was found on them.

Oct 23 1880

tried some Carbons with Gasoline got it up to a very high heat. The deposit on it was a kind of wooly appearance.

Also tried some with the oil of paraffine and got it up to a very high heat

~~Had some~~

Had some carbons also with paraffin ie got this one up to a very high heat.

Oct 26 1880

Tried some naphthaline by boiling some of it in a flask (heated on a sand bath in the [illegible] in which [illegible] the gas, ~~was it~~ [illegible] at the bottom [illegible] two pieces of card board and then laid two carbons on top of them and then covered [illegible] another piece [illegible] and heated it to a pretty good heat, nearly

white! when taken out it had a silvery appearance, the carbons had this [illegible]

Tried it alcon again with naphthaline that we used before [illegible] could [illegible] get good results.

we also tried [illegible] it was to be supp[illegible] [illegible] with [illegible] but [illegible] result,

[illegible] one without [illegible]
the [illegible] about [illegible]
[illegible] flock [illegible]
to [illegible]

[illegible]

[illegible]

the cardboard [illegible]
[illegible]

40

6) 200 ($1.48 \over 13\,320$) 7

$1.48 \times 40 = 13\,320$ 4

7

.64) 133 (2.
128
5

$43.2 \times 2 = 86.4$

40 = 64 Df. Dec 7/1880

40) 64 (1.6 = one cell
240
240

~~1.08 × 40 = 43.20~~

1.08 × 40 = 43.20

64 D = 43.2

64) 43.0 (.675 = 1 D
38 4
460
448

.675) 33.000 (7 .197

8.3645163
1.8061800

43.2) 64.0 (1.48
43.2
2080
1728
3520

1.48

Leading wires = 21.ohms
D.C from machine without
mulplate 16.5 X .675 = V

$$\begin{array}{r} .675 \\ \hline 825 \\ 1155 \\ 990 \\ \hline 11.1375 \end{array}$$ Volts

$\frac{\pi^2}{.28} \times 44.3$

π

$$\begin{array}{r} 1.1702617 \\ 0.9294189 \\ \hline 2.0996806 \end{array}$$

125.8

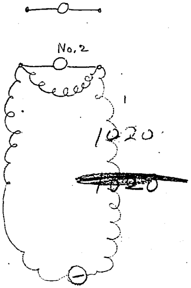
Dea

55.6 —

1.08
20
2160 volts   1080
40
4320

4320 volts

64) 200 (3.1   43.
192
80



Dec 11 1880.

* 76 – 76 45° | 16e

6279
366

200) 6644 (33.90 ~~0~~4 1/3"
600
640
600
40

Tuee 22

33 ohms

3.7616272
8.4814861
1.6464037
3.8895170

1.0808136
3.7616272

7753.

~~77~~

76
76

7729) 33000 (4.1 ...
28916
10840

33) 25588.0 (7729.
231
240
231
098
66
320
297

2

7

1.7101174

3.4202348
1.6464037
8.4414561

3.5481246

3532.

3532.)

5480

4.5185139
3.5481246

1.0303893

1.05 40

4.320
43.2

432 : x :: 64 : 76
76
2592
3024

64) 32832 (51.3
320
83
64
192

355

3532) 33 (9.3
31788
124120
14128

48 e

Def 91-

6279
230
200)6509 (32.5
6004
509
400

51420

330000

43.2 : x : 64.91

1.6354837
1.9590414
8.0193819
1.7883441

3.5766882
1.6464037
8.4881166
3.7112085
5

6.2887915
4.5185139
1.8073054

6.4 H.P.

Second Test

Dep a Lunap. 72 – 72

Basil 63.64

6279
870

2096649 (33

649 43.21 K : 635 72

1.6354837
1.8573325
8.1972263

1.6910426

3.3820852
1.6464037
8.4814861

3.5099750. ft Obs
6.4900250 3235.
4.5185139

0.0085389 H.P 10

43.2
72

864
3024

635) 311.04 (5

64) 31104 (48
256

550
512

380

33) 106360 (3221.
99

73
66

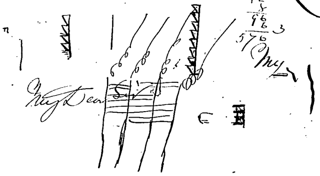
70
66

3221) 38000 (49.
28989

40110

Ra P Para Paradise Lost

12
8
96
576 6 3



My

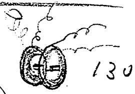
My Dear Sir

Small coils

~~$3\frac{25}{100}$ 3.25~~

× $3\frac{25}{100}$ ohms

$3\frac{27}{100}$ ohms



130

large coil

32.50 ohms (X)

33.50 ohms

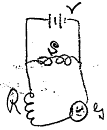
378

51

33) 115220 (3491
99
162
132
302
297
60

3491) 33000 (9,4
31419
15810
13964

Res of a Battery



$\frac{5}{25}$ $\frac{1}{5}$ $\frac{20}{25}$ $\frac{4}{5}$

$$C = \frac{\mathcal{E}}{r + \frac{S(R+g)}{S+(R+g)}}$$

current through the gal =

$$\frac{\mathcal{E}}{r+\frac{S(R+g)}{S+(R+g)}} \times \frac{S}{(R+g)+S} =$$

$$\frac{\mathcal{E}\cancel{(S+(R+g))}}{r(S+(R+g))+S(R+g)} \times \frac{S}{\cancel{S+(R+g)}} =$$

$$\frac{\mathcal{E}S}{r(S+(R+g))+S(R+g)}$$

$$C = \frac{\mathcal{E}}{R+g+r}$$

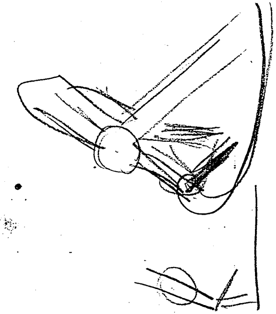
$$\frac{\mathcal{E}S}{r(S+(R+g))+S(R+g)} = \frac{\mathcal{E}}{R+g+r}$$

$$\mathcal{E}S(R+g+r) = \cancel{\mathcal{E}(rS+rR+rg)}$$

$$\mathcal{E}(rS+rR+rg+SR+Sg) =$$

$$\cancel{\mathcal{E}SR} + \cancel{\mathcal{E}Sg} + \cancel{\mathcal{E}Sr}$$

$$\cancel{\mathcal{E}rS} + \mathcal{E}rg + \mathcal{E}rR + \cancel{\mathcal{E}SR} + \cancel{\mathcal{E}Sg}$$



$$\frac{ES}{r(S+R+g)+S(R+g)} = \frac{E}{R_1+g+r}$$

$$ESR + ESg + ESr =$$
$$ErS + ErR + Erg + \cancel{ESR} + \cancel{ESg}$$

$$ESR_1 + \cancel{ESg} + \cancel{ESr} =$$
$$\cancel{ErS} + ErR + Erg + ESR + \cancel{ESg}$$

$$ESR_1 = ErR + Erg + ESR =$$

$$r = \frac{ESR_1 - ESR}{ER + Eg} =$$

$$r = \frac{S(R_1 - R)}{R + g}$$

$$r = \frac{S(R_1 - R)}{R + g}$$

Def	V	Def	V	Def	V
	20 cell =	32 def	1 def = 1.4814		
1	.675	21	14.17	41	27.67
2	1.35	22	14.85	42	28.35
3	2.02	23	15.53	43	29.02
4	2.70	24	16.20	44	29.70
5	3.38	25	16.87	45	30.37
6	4.05	26	17.47	46	31.05
7	4.73	27	18.22	47	31.72
8	5.40	28	18.90	48	32.40
9	6.08	29	19.57	49	33.07
10	6.75	30	20.25	50	33.75
11	7.43	31	20.92	51	34.42
12	8.10	32	21.60	52	35.10
13	8.78	33	22.28	53	35.77
14	9.45	34	22.95	54	36.45
15	10.10	35	23.62	55	37.12
[illegible]	10.80	36	24.30	56	37.80
[illegible]	11.47	37	24.97	57	38.38
[illegible]	12.15	38	25.65	58	39.15
19	12.83	39	26.32	59	39.82
20	13.50	40	27.00	60	40.50

log 1.48144 = 10.1706962

61	41.17	80	54.00	98	66.15
62	41.85	81	54.67	99	66.82
63	42.52	82	55.35	100	67.50
64	43.20	83	56.02	101	68.17
65	43.84	84	56.70	102	68.85
66	44.55	85	57.33	103	69.36
67	45.22	86	58.05	104	70.36
68	45.90	87	58.72	105	70.87
69	46.57	88	59.40	106	71.55
70	47.25	89	60.07		
71	47.93	90	60.75		
72	48.60	[illegible]	61.42		
73	49.27	92	62.10		
[illegible]	49.95	[illegible]	62.77		
[illegible]	50.62	[illegible]	63.45		
[illegible]	51.30	95	64.13		
77	51.97	96	64.80		
78	52.65	97	65.47		
79	53.32				

✓

107	72.23	121	81.67	135	91.12
108	72.90	122	82.35	136	91.80
109	73.58	123	83.03	137	92.47
110	74.25	124	83.70	138	93.15
111	74.93	125	84.37	139	93.82
112	75.60	126	84.97	140	94.50
113	76.28	127	85.72	141	95.17
114	76.95	128	86.40	142	95.85
115	77.60	129	87.07	143	9[illegible]2
116	78.30	130	87.75	144	97.20
117	78.97	131	88.42	145	97.[illegible]7
118	79.65	132	89.10	146	9[illegible]5
119	80.33	133	89.78	147	99.22
120	81.00	134	89.45	148	[illegible]
				149	100.57

150	101.25	166	112.05	181	122.17
151	101.92	167	112.72	182	122.85
152	102.60	168	113.40	183	123.52
153	103.27	169	114.07	184	124.20
154	103.95	170	114.75	185	124.83
155	104.62	171	115.43	186	125.55
156	105.30	172	116.10	187	126.22
157	105.88	173	116.77	188	126.90
158	106.65	174	117.45	189	127.57
159	107.32	175	118.12	190	128.25
160	108.[illegible]	176	118.80	191	128.92
161	[illegible]7	177	119.47	192	129.60
162	109.[illegible]	178	120.15	193	130.27
163	110.02	179	120.82	194	130.95
164	110.70	180	121.50	195	131.63
165	111.34			196	132.30
				197	132.97

198	133.65	216	145.80	235	158.62
199	134.32	217	146.47	236	159.30
200	135.00	218	147.15	237	159.97
201	135.67	219	147.83	238	160.65
202	136.35	220	148.50	239	161.32
203	137.02	221	149.17	240	162.00
204	137.70	222	149.85	241	162.67
205	138.38	223	150.53	242	163.35
206	139.05	224	151.20	243	164.02
207	139.73	225	151.87	244	164.70
208	140.40	226	152.47	245	165.37
209	141.08	227	153.22	246	166.05
210	141.75	228	153.90	247	166.72
211	142.43	229	154.57	248	167.40
212	143.10	230	155.25	249	168.07
213	143.78	231	155.92	250	168.75
214	144.45	232	156.60	251	169.42
215	145.10	233	157.28	252	170.10
		234	157.95	253	170.77

254	171.45	275	185.62
255	172.12	276	186.30
256	172.80	277	186.97
257	173.38	278	187.65
258	174.15	279	188.32
259	174.82	280	189.
260	175.50	281	189.67
261	176.17	282	190.39
262	176.85	283	191.02
263	177.52	284	191.70
264	178.20	285	192.33
265	178.84	286	193.05
266	179.55	287	193.72
267	180.22	288	194.40
268	180.90	289	195.07
269	181.57	290	195.75
270	182.25	291	196.42
271	182.93	292	197.10
272	183.60	293	197.77
273	184.27	294	198.45
274	184.95	295	199.13

296	199.80
297	200.47
298	201.15
299	201.82
300	202.506

951)4900(.05
155

921)7900(.085
7368
5320

2

1.6879746
2.9782947
$\overline{2}$.7096799

1.8976271
2.9642596
$\overline{2}$.9333675 .0512 .0857
.0512
.0345

1000 − 48.75

48.75 mm leading wires

79 leading wire + machine

1000.00
48.75
951.25

48.75 : 951.25 :: 1 : X

2.9782947
1.6879746
0.2903201

1000
79
921

1.95

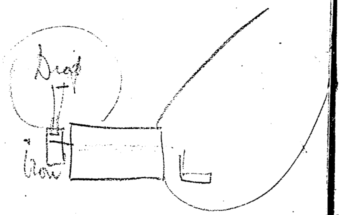
951.25 : 48.75 : 1 X
921 : 79 : 1 : X

115 through 10000

338 . 10000

52

52) 3380000 (65000
312
260
260



Feb 6

Metric Experiment

68.D = 300

$$\frac{1.08 \times 6}{6.48}$$

6.48) 30000.0 (46.2

25 92

4080
3888

1920

46.3

2778

46.3 × 6 = 277.8

46.3
648

3704
1852
2778

290024

46.2 Def = 1V

Res of No. 6

16

20
20
400
4.4
1600
1600
17.604
70.4
10.
28 1,6

2

40
40

134
134
536
402
134
.17956
7854

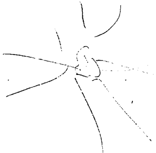
.07854

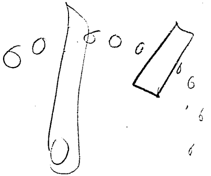
.7854
12
31416
7854
.109956
40
4398240

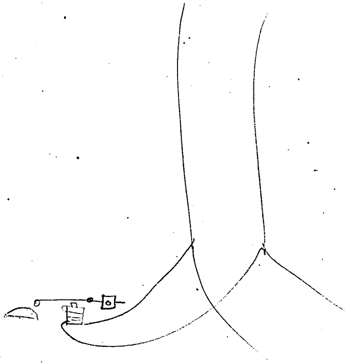
.17956
40
.718240

1.357

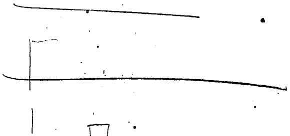
.4398

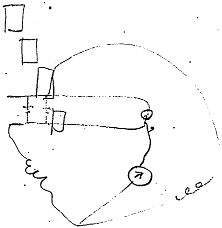


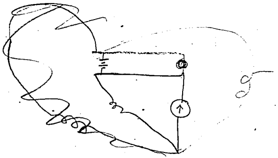


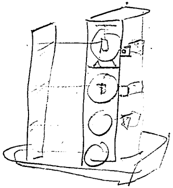


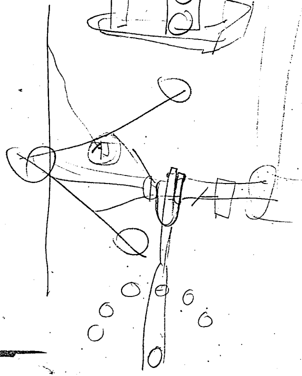
110











$\frac{x}{10} + 10 = \frac{x}{4}$

120

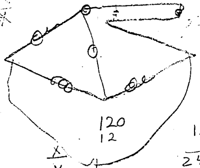
$2x + 200 = 5x$

$2x + 200 = 5x$

$4x$

$357 - 300$

6



$\frac{x}{10} + 10$

$4x$

120
12

120
120
2400

$\frac{x}{10} + 10 = \frac{x}{\frac{x}{4}}$

$4x$

$3x$

120
1444
576
5-96
65-3.1

$3x$

$\frac{3x}{3x^2}$

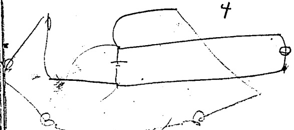
$\frac{x}{10} + 10 = \cancel{4x}$

x^2

1000

$x + 100 = 4$

$4 \overline{)4x}$
4



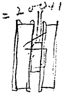
$\frac{x}{10} + 10 = 4$

$\frac{x}{4} - x = 10 + \frac{1}{30}$

$x + 100 = 40$

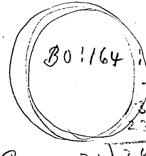
$3x + 20x = 20041$

$\frac{x}{10}$



233

30



30:1164 | 233 | x
164
932

1273
233
1050

$\frac{C}{E}$

$30 \overline{)382}$
30
82

1273

5.60

3

45
3
290
30

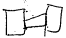
$\frac{E}{C}$ $\frac{E}{C}$ C

Cr - E

40
3
180
20

R

R



$r = \frac{E}{C}$

Def on Magnet Deap

31

112 4.0984360
141 1.6464037
7.8507809

3.5956206 ft Cos

6.4043704
4.5185139

0.9228543

8.4 H.P.

30

119
157

40

4.1510940
1.6464037
7.8041003

3.6015980 ft Cos

6.3984010
4.5185139

0.9769149 [illegible]

~~8.7~~ H P, 8.2 H.P.

Dec 14th 1880

%10 Magnet	machine		# 5. magnet	machine	
0	18	18	0	12	12
0	28	28	1	20	20
1	40	40	2	32	31
2	51	52	3	40	40
3	63	63	2	50	50
3.5	74	74	4	59	59
5	89	89	5	70	70
8	107	107	5.5	85	85
10	119	119	7	105	105
11	130	130	11	122	122
16	140	140	14	131	131
22	145	145	11	138	138
32	155	155	19	142	142
68	170	170	30-31	150	150
			65	165	168

Dec 14

1 ω = 124

2

170
3)340
113

Lamp 184

166 ohms

185
2
3370
123

15) 64 (427

4.1798102
1.6464027
7.7798919 2

3.6061058

3.9938942
4.8185139

0.9124081

8.2 H.P.

¼ lamp

16

111.0
138 R

4.0906460
1.6464037
7.8601209

3.5971706

1.4884

3.5 H.P.

123

15

Aug 19

105.

136 R

4.0423786
1.6464037
7.9864611

3.5552434

6.4447566
4.57185139

0.9632705

9.2 H P

4.0423786
1.6464037
7.9788107

3.6675930

6.3824060
4.57186739

0.9509199

8.9 H.P.

105. ≢ ∪ $R = R_1$

$c = \frac{\varepsilon + \varepsilon_1}{} \quad = CR = \varepsilon + \varepsilon_1^x$

$c_1 = \frac{\varepsilon^R - \varepsilon_1}{R} \quad CR = \varepsilon - \varepsilon_1^x$

$\varepsilon_1^x + \varepsilon = \underline{CR}$

---

to lin Mädchik rey

$\left.\begin{matrix} R \text{ of } x. \\ R_1 \text{ of } y \end{matrix}\right\} = R + R_1 \left| \begin{matrix} \varepsilon \\ \varepsilon_1 \end{matrix} \right.$

$C = \frac{\varepsilon + \varepsilon_1}{(R+R_1)R_2} = \quad CR = \varepsilon + \varepsilon_1$

$C_1 = \frac{\varepsilon - \varepsilon_1}{(R+R_1)R_2} \quad C_1 R_2^2 = \varepsilon - \varepsilon_1$

$R_2 = \frac{\varepsilon + \varepsilon_1}{}$

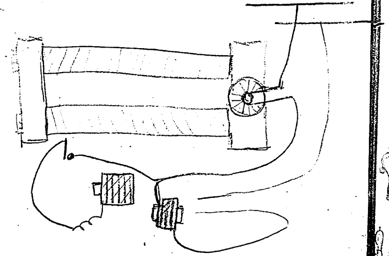
$R_2 = \frac{\varepsilon + \varepsilon_1}{}$

$R_2 = \frac{\varepsilon \underline{C} \varepsilon}{c_1}$

105 - V from 130 - 160

4.0423786

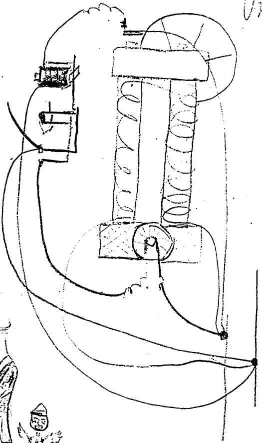
4.0423786

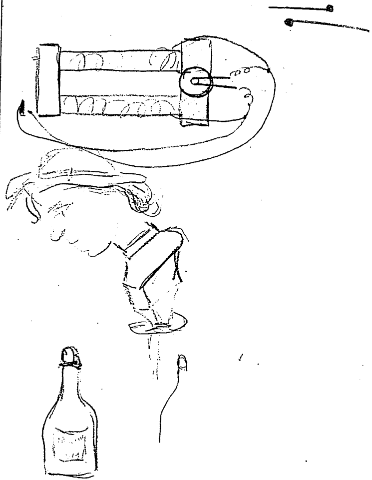


Dec 21 1880

Edisons Motor

Francl





18840
~~4500~~
23340
~~11670~~ ohm
11

18840
4800
23640
113,2

1000
90
910

90 : 910 : 10 : x

2.9590414
1.~~0000000~~
8.0457575
2.0047989

Lamp to get its curve Jan 20 1880

Res	Ele.	Cam	R	E	C
Cold 176	13.50	0	116	99.22	14
129	66.85	1	116	99.94	15
126	75.60	2	115.5	101.25	16
125	79.65	3	115	101.9	17
122	84.37	4	114.5	103.29	18
121	85.72	5	114	104.62	19
120	87.75	6	113.5	105.20	20
119	89.45	7	110	108	25
118.5	91.12	8	109	110.70	30
118	93.82	9	107.5	112.72	35
117.5	94.50	10			[illegible]
117	95.17	11	105	117.45	50
116.5	95.85	12			
116	97.87	13			

31406
3800
2) 35206
176 ohms

2364
118

71.14000 : X :: 35206

110

$$\frac{X}{35206} = \frac{71}{14000}$$

R	C	V	R	C	V
Cold					
174	0	13,50			
133	1	7087			
125,5	5	87,75			
122,2	10	95,85			
120	15	101,25			
118,2	20	106,65			
116,5	25	109,35			
116	30	112,05			
114,5	35	114,75			
112 -	50	118.80			

31406
3500
2|34906
174

18840
5600
24440
122,2

25127
1500
2|26627
133

12,563

18840
4500
23340
1167

18840
5600
24440
122,2

18800
5200
24000
120

18840
4800
23640
118,2

18840
4100
22940
1147

18840
4350
23190
115,95

 .01 machine Jan 21 1881

def, Rev 76

76 1030

78 1030

53

53 | 1000 | 65

53)650000(122

1120

1060

840

.12560

.500

12560

.577

87920

87920

62800

1052)724.7120(13 365.

204

487

468

190

156

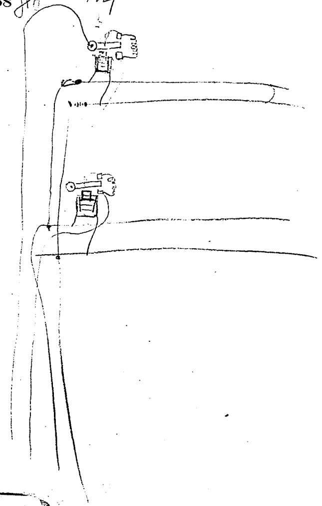
340

312

260

1.124900

Feb 4.



C F

37	7	139
1	2	147
2	3	155
3	4	167
4	5	183

2

800 : 200 × .01875
800
14.9600

200) 14.9600 (.06

.018700
200) 14.9600 (.07

.1000
139
861

861 : 139 : × : .0187
861
187
1122
1496
139) 161007 (.11
139
220
139

453.6)1000.0 gr. (2.20
9072
9280
9072
2800

1390
22
2780
2780
30580.0 ft = 1 Cal 4403

2 1½ 2

1 C = 22.7 W

772
2.2

1544
1544

1698.4 ft lbs. per Cal

1 W = 44.3 ft lbs.

.24065

84920
84920
91904
67936
88968

~~8779960~~
4086.19960

1390 ft lbs

1,390 ft

1390 = Calorie
.240
55600
2780

4430
177
1886
106

772
202
1544
1544
1698.4 ft lbs

)1698.4

4)150(25
20

4/10)40

44.3 ft w.

W = 44.3 ft lbs

1698.4

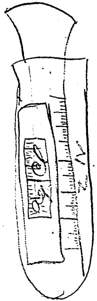
1698.4 ft = 1C

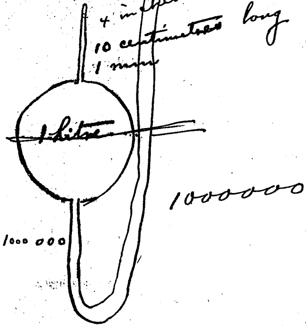
.2)1698.40000(

~~169.8~~

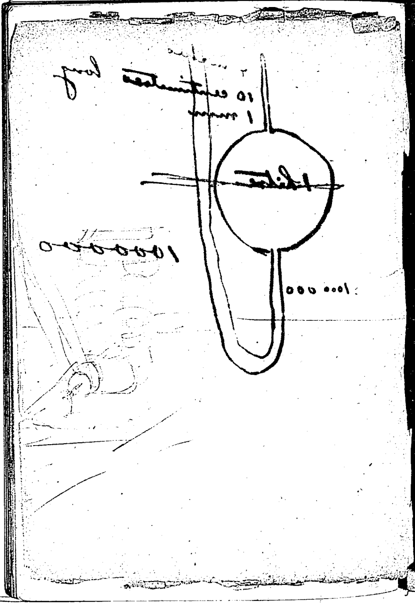
100) 1698.4 (16.98
100
698
600
984
900
84

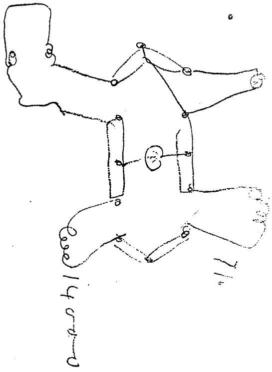
16.9
2.4
676
338
40.56





4 inches
10 centimetres long
1 mm
~~1 litre~~
1000000
.1000 000


10 centimeters long
1 gramme
1000000
1000 000


14 cm

$\frac{5}{9} - 32 = e$ $\frac{5}{9}(7-32) = e$

$e = (-\frac{5}{9}7 + 32)$

46

$\frac{5}{9}(7-32) = e$ $\frac{5}{9}(7-32) = e70$

$\frac{57}{9} - \frac{160}{9} = e$ $\frac{57}{9} - \frac{160}{9} = 70$

$57 - 160 = 630$

$57 - 160 = 9.6$

$e = \frac{57-160}{9}$

$\frac{57}{9} - \frac{160}{9} = e$

$57 - 160 = 9e$

$57 - 160 = 414e$

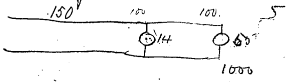
$\frac{57}{9} - \frac{160}{9} = 46$

$-\frac{160}{9} = 9C$ $\quad \frac{160}{9}$ $\quad 18$

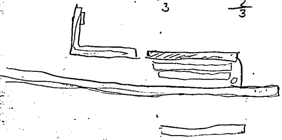
70

$-\frac{160}{9} = 46$

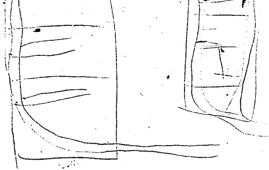
5704



$\frac{1}{3}$ $\quad \frac{2}{3}$



$-160 = \boxed{504}$



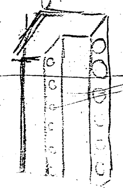
$-\frac{160}{9} = C$

46
32
78
15
125

$-\frac{160}{1} = 9C$

$\frac{5}{9}(F = -32) = C$

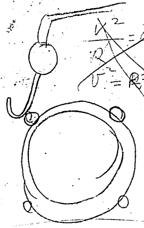
Pot. Ferricyanide 3 parts
Citrate of iron Ammon 5
H_2O 40



12.5

Pot. Ferricyanide 3 parts
Ammon iron citrate 5
water 40

15 $\frac{12.5}{60}$ 62



~~$\frac{v^2}{R} = 44.3$~~

~~$v^2 = R \cdot 44.3$~~

12.5

$\frac{v^2}{R} \cdot 44.3$

$\frac{v^2 (44.3)}{R}$

Menlo Park Notebook #105 [N-80-06-02]

This notebook covers the period June-August 1880. Most of the entries are by Charles Batchelor. There are also a few entries by Neal Van Cleve. The first few pages contain a record of carbons, kept by Van Cleve. Following this are notes and drawings by Batchelor relating to carbon experiments; notes and drawings of a bamboo splitter, a clamp-making machine, and an instrument for attaching carbons; notes on "faults to be looked for" when testing carbons; drawings of a lamp socket; and notes and drawings of insulation for a dynamo armature. The book contains 284 numbered pages. Pages 137-138 were torn out of the book and taped in between pages 92 and 93. Pages 16-19 contain skeleton tables that were never filled in. These tables have not been filmed.

Blank pages not filmed: 118-133, 142-239, 242, 247-266, 277, 280-281.

Missing page numbers: 3-4, 99-100, 137-138, 243-246, 267-276.

June 2nd 1880

Bast fibre 9/1000 x 12/1000 carbonized alone

Carbon Record

Van Cleve

July 2. 1880

Date	Material	No. Taken in	Taken out
June 23	Platinum chloride Bast) alcohol	1	1
July 9th	ammonia Salts of Platinum Bast)	1	1
	12 x 12 5/64 or wide 6 inch long (Bast	5	5
Paper Carbonized	also paper Carbon 12 x 12 1/2/1000	6	1
	also 9/1000 x 12/1000 Bast fiber	2	2
	also Palmetto fiber	4	4

Remarks

Date	Material	No: Put in	No. Taken out
July 7	12 x 10/1000 Palm leaf fiber	6	3
	12 x 12 Also Bamboo fiber	6	3
June 9th	Rye Straw 12 x 10/2/1000 Pitch on one side	6	1
10th/1880	Bristol Board fibers 6 12 x 12	6	2
July 12th	12 x 12 Bamboo fibers Regular size		4

Remarks

1 Bituminous Coal

2 Kerosene

3 Paraffin

~~4~~

Date	Material July 28.	Nos Put in	Gotten out
4	Naphthaline		
5	Benzine		
6	Camphor		
7	Turpentine		
8	Aniline oil		
	Anthracine		
10	Reguan in Kerosene		

Date	Material	No. Put in	Taken out
	Bisulphide Carbon		
12	Glycerine		
13	Oil Myrbane		
14	Asphaltum		
15	Regular ~~without anything~~		
16	Cod liver oil		
17	Castor oil		

Remarks

July 28

Date	Material	No. Put in	Taken out
18	Nothing in at all made ~~to compare the others with~~		
19	Narrow straight one		
20	Regular		
21	Tar		
22	Bisulph Carbon		
23	" " " Chalk		

Remarks

Date	Material	No. Put in	Taken out
24	Small narrow mounts		
25	wide mounts with a little tar on ends to prevent cracking		
26	Tar ~~painted on~~ them		
27	wide a little tar put in paper to make vapour of tar		

6 Bamboo fibres the ends dipped in Sol. Double Chl. of Amm and Pt before Carbonization none of it to be got on thin part ~~the ends~~ ~~dipped~~ And 6 a portion of thick solution dropped on ends and recarbonized

OK

B57

2 on page 139
2 " " 137
2 " " 161

Try. exp. Double Chl NH_4 237

1 6 Bast fibres
OK the end dipped in
Double Chloride Amm.
and Pt and Carbonized

2 6 Bast fibres (carbonized)
OK a portion of a drop put
on each end and
recarbonized July 13 1880
Chas Batchelor

No 3
Take 6 Bamboo fibres
Dip ends in Sol. Chl ~~NH4~~
~~and~~ Pt and Carbonize

---

4 Take 6 Bamboo fibres
(Carbonized)
put portion of a drop
on ends and recarbonize

July 13 1880
Chas Batchelor

Cut from thick end of Cane
4 pieces 3.75 long —— 3.02
.123 wide —— .094
.0835 thick —— .045

From thin end of Cane
3 pieces 3.00 long ——
.121 wide ——
.060 thick ——

After Carbonization

percentage of Shrinkage

See page 29

July 13 1880
Chas Batchelor

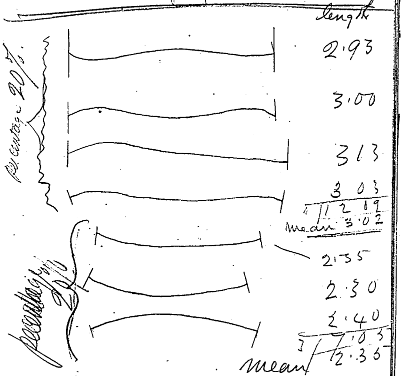
5 Take 6 old papers Carbons and treat ends with double Chl. NH_4 and Pt put in Lamps

6 Bamboo pieces $\frac{1}{8}$ square laid in mould and carbonized Edison wants to study them under microscope OK
OK

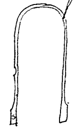
7 ~~Have Haid make a strong alcoholic solution of Double Chloride NH_4 and Pt wait it~~
OK

& soak well into the pores of fibres + carbons — Ask him about strengths ~~and~~ etc of same

July 13 1880 Chas Batchelor



8 Make two Bamboo fibres with a fault in so:-



OK.

+

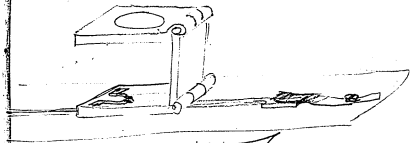
9 6 Bamboo—Carb.—
~~4~~ soaked in hot Syrup and re Carb.
~~4~~ of these resoaked & Carb.
2 of these last resoaked & Carb.

July 14 - 1880

Notes -

I see some lamps have the carbon cracked in the clamp so that one portion is red and another black - Cause irregular surface for clamping = Remedy make mould right so ~~that~~ there is not too much room anywhere

Testing fibres Aug 2d 1880



Faults to be looked for

1 Some places cut into or narrower than others

2 Some places where there seems to be a portion of a fibre torn out

3 Some places where there seems to be a split extending a short distance

4 Curves at ends cut too deep in

5

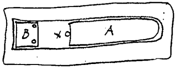
Carbons

Aug 4th 1880

Chas Batchelor

On our gas furnace (which works elegantly) we can make an improvement by making it up of bricks moulded right shape & binding together so as to allow a little shrinkage and expansion

I find that in our mould sometimes the large weight moves by reason of the small weight sticking this I remedy by putting a pin at X which is made moveable

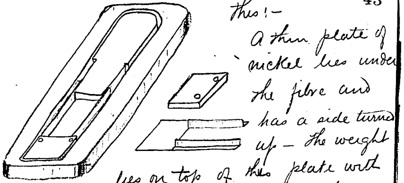


The sticking of the small weight is due in some cases

to small globules of metal or other substance coming out of the nickel at a high heat

These globules sometimes actually hold up the small weight so that its pressure is not felt on the fibres and ~~consequently~~ the ends are not ~~flat~~ — In such a case when the fibre shrinks it pulls the weight by jerks and when finished is corrugated

A good way to obviate part of this is to make a mould like



this:-

A thin plate of nickel lies under the fibre and has a side turned up — the weight lies on top of this plate with the fibre ends in between — The sides of this plate ~~has~~ also confine the body of the fibre to a smaller chamber thus making less liability to oxidization ————

Aug 4 18[illegible]

[illegible]

Aug 5 1880
Chas Batchelor

In carbonizing chamber I let the fibre ends rest on carbonized tissue paper and also in another on uncarbonized tissue - both of these brought the carbons out very straight and flat I shall try both on a full set in our gas furnace as it will prevent weight sticking —

Later This I have tried in nine chambers ~~together~~ in gas furnace and they were all good. CB

Aug 4 ~~A~~ 1880

two Molds put through gas one burner under opposite Ends of Mold in regard to the Bending of the carbon

Carbons Aug 4th 1880

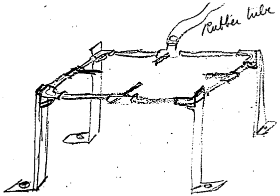
Chas Batchelor

We are considerably bothered with the carbons bending over whilst they are on the pumps We think this must be due to ~~to~~ unequal heating so I have ~~made~~ put up 2 fibres in moulds and heated up only one end of each in the preliminary heating ==

Carbonizing Aug 5th 1880

In making the gas and wind pipes for the other moulds I propose to arrange it so ~~that~~ each pipe will ~~lift out~~ of the way and connect ~~with~~ flexible joints of rubber ~~to~~ main

Chas Batchelor



Carbonizing Aug 5 1880

Chas Batchelor

It would be more economical in our gas carbonizing furnace to blow in hot air instead of cold and this might be done so:-

5·00 = ~~00~~ = 1·00 = 4·00
5·10 — 1·02 4·08

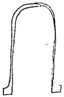
51
102

4

Carbonization Aug 6 1880

The carbons bend over in bringing up on the pumps —— This may be due to:

1 Too low a heat in carbonizing



If they are not heated sufficiently in Carbonizing when they are put on the pump and heated a great deal higher the outside shrinks more than the inside; and the clamps being held tight it has to bend over to adjust itself — for instance we will say the outside line is 5·10 and

the inside 5· then a shrinkage of 20% would make it 4·08 to 4· incl a difference of only ·08 instead of ·10 - now the carbon in last heating as the clamps are fast the outside must necessarily take another position in order to become proportionately shorter —

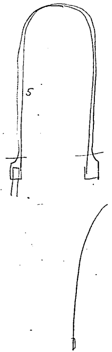
Now we will make the following experiments :—

over page 61

5·

20°c

5— 4
5.10 4.08



Carbonizing Aug 8th 1880

1st Make 3 in ordinary
XXX manner but not extra
heat in muffle OK

2nd Make 3 in ordinary
XX manner with intense
heat in muffle
~~put them in Ovens when put in muffle~~

3 Make 3 with uneven
XX heat on preliminary heating
and intense heat in muffle

4 Make 3 without preliminary
heating but intense heat
in muffle

5 Take 3 ordinary ones
XXX from top of new gas furnace
with 15 in p 201 B. 57
OK done

---

6 Take 3 from bottom of p 201 Book 57
XXX ditto OK done

---

7 Take measurement of
3 after preliminary heating

---

8 Take 3 from middle of
X gas furnace mould and
bring to high heat in muffle

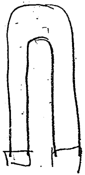
---

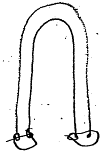
9 Take bunch of about doz from
XX gas furnace lot and bring to
incandescence over to 71

Notes. The original length of all is 6 $\frac{21}{32}$ inches —

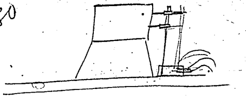
After Carbonization total length from top of curve to base of clamp is as follows —

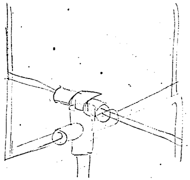
No	Length	Remarks
1	$2\frac{13}{32}$	
2		
3		
4		
5	$2\frac{13}{32}$	
6	$2\frac{13}{32}$	
7		
8		
9		
10		
11		
12		

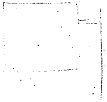




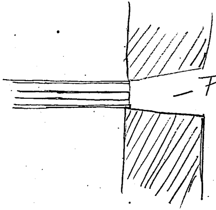
Furnaces
Aug 8 1880







3 — $\frac{3}{8}$ gas cocks
1 Reducing coupling $\frac{5}{8}$ to $\frac{3}{8}$
2 Cross tees $\frac{5}{8}$ pipe



— Furnaces Aug 8th 1880
Chas Batchelor

10 Take 2 of the old ones from
XX the gas furnace —

Carbonization

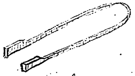
Aug 13th 1880

Chas Batchelor

The cause of the bending over of the loop after it is heated in vacuo we thought was due to insufficient heating in carbonization but after a series of experiments to determine that point we came ~~to the~~ conclusion that whether heated slightly or to a high temperature some of each bent whilst others kept straight

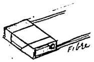
We then remembered that some bamboo fibres which were 4" long and of which we made a great number almost all kept straight

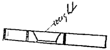
we also remembered that almost
all these were put in the clamps
edgeways instead of flatways
this led us to ~~think~~ see that



~~probably~~ the way Bradley
cut them from the Cane,
and the bending them flatways
afterwards, would leave the 'pith side'
on one face and the 'hard shell'
side on the other face unequal
shrinkage of course must occur
on two such faces and cause
the bending— We now made
a mould for carbonizing that
would hold the fibre edgeways

so:- this made moveable weight of three pieces the middle piece pressing out the sides to suit the shrinkage of the fibre in thickness.





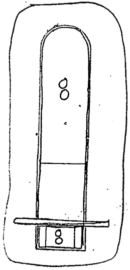
From this mould we tried some on the pumps and they not only were perfectly flat themselves but did not change their upright position with the most intense heat we could get on them

Chas Batchelor
Aug 13" 1880

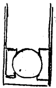
Carbonization

Aug 13 1880

Chas Batchelor



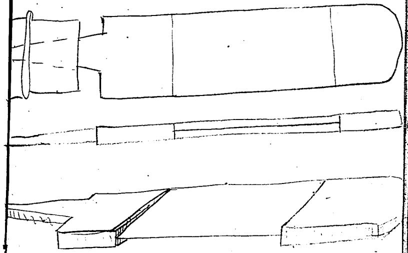
Mould with pin across to hold fibre tight so that it can pull the large weight down — wedge weight for keeping the clamp ends flat



Circular weight for keeping clamp ends flat

Aug 18th 1880

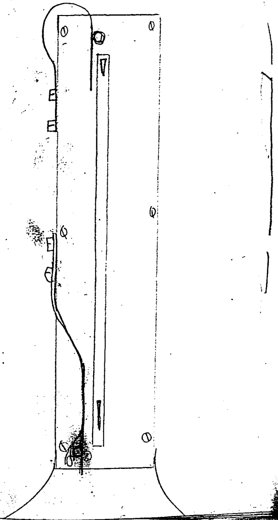
Make a Knife for splitting Bamboo so from an old file



Bamboo Splitter

Aug 18th 1880

Batchelor



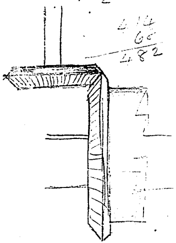
Wright 600
300
900

30/22

137
22/168
168
30
138

800

22
414
68
482

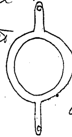


1165

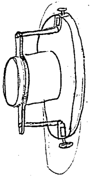
22 100
88
120
100

Dynamo Machines Aug 24/1880
Chas Batchelor

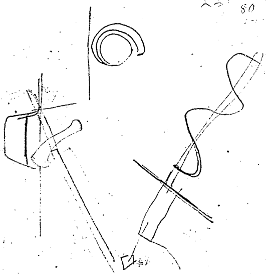
The connections on the back of the armature might be made in the following manner:— Cut out a number of pieces like this:—



Now put together (insulated from each) other) by mica) as many of such pieces as there are connections and set each one a ~~little~~ ahead of the other and connect to a plate holding the bindpost and wires by stud across



1.37
22
274
274
3014
22 80



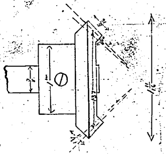
Lamp Machine

Aug. 25th 1880
Chas Batchelor

Bevel Wheels for [illegible] movement

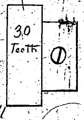
Large – 100 teeth – Pitch 4·00 – face $\frac{5}{16}$
Small – 30 teeth – " 1·37 – " $\frac{5}{16}$

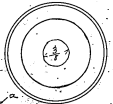
Pitch 22 –
Depth of tooth ·10



Large bevel 52 degrees [illegible] gear

53½ Degrees
at the centre of face ·098 deep





Pitch line 1·34
Whole Diam 1·46
3/8 hole.

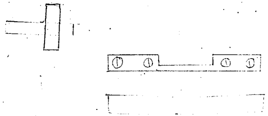
distance at point a must be 1/100 more than at b.

Small Spur gear Depth of teeth $\frac{93}{1000}$

Number of teeth 30

Large " " Depth " " $\frac{88}{1000}$

Number " " 180



17
17
4
38
32
118
114 6
119

17
14
13
50
24
200
100
120

17×2−4

17
3
34
32
68
102
108 8

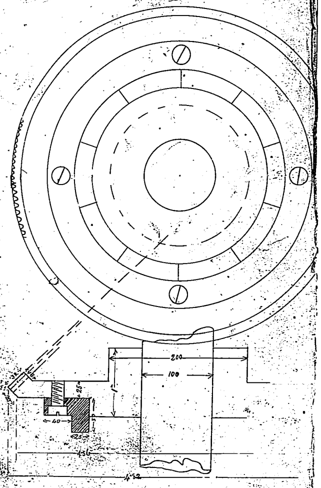
17
136
544
272
326

Carbon Machine
Large gear.

Book 105

Aug 25 1880
Chas Batchelor

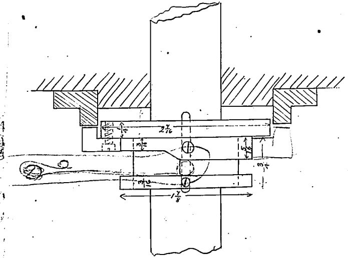
22 pitch 100 teeth
Depth of ~~tooth~~ in centre 1/10



Clutch for Clamp Machine

Aug 25th 1880

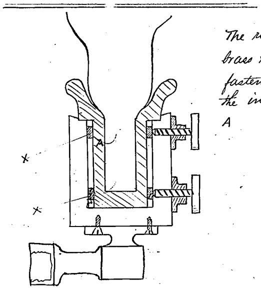
Chas Batchelor



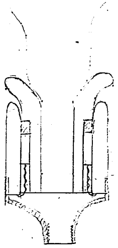
Lamp Socket

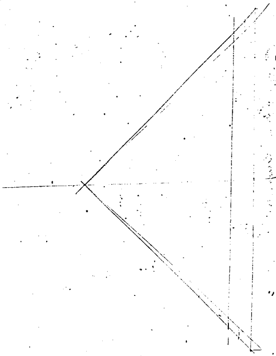
Aug 25th 1880

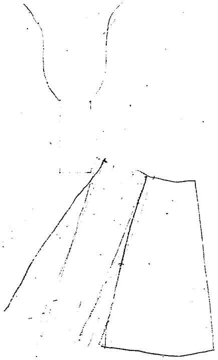
Chas Batchelor

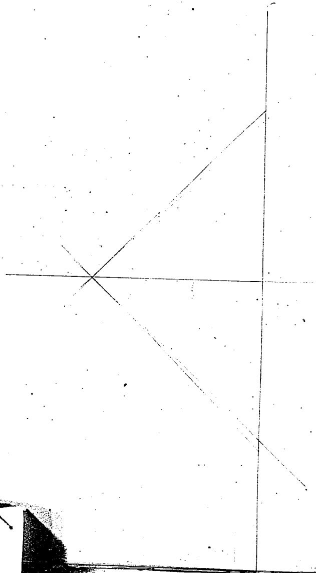


The rings of brass x x to be fastened on to the inside socket A





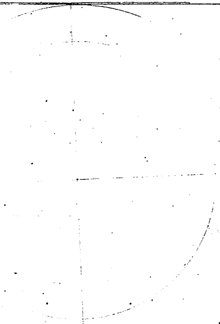


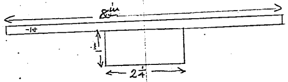


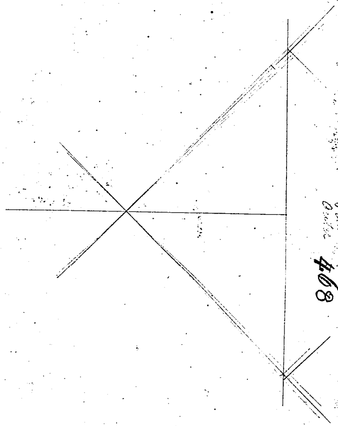
Pattern for Cam plates for clamp machine

Aug 25 1880

Chas Batchelor



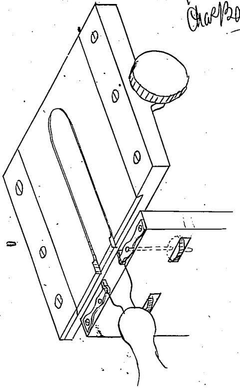


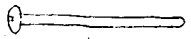


Pitch 4.55
Carbon
#68

Aug 26 1880
Chas Batchelor

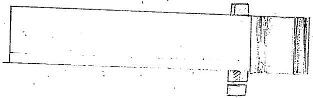
Inst for putting in Carbons





Clamp Machine Aug 30/1880

Bending Cam to be altered to new drawing

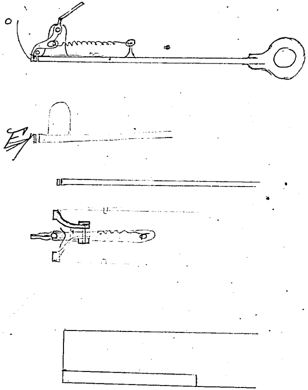


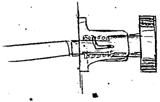
Clamp Machine

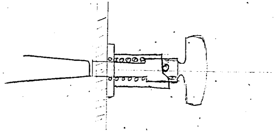
New motion for holding metal while punching

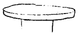
Aug 22d 1880

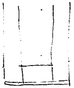
Chas Batchelor

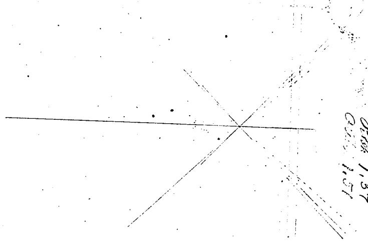












Pitch 1.37
[illegible] 1.57

The extrem Diameter of large					4.58
Largest pitch	"	"	"		4.55
"	"	"	"	Small	1.37
"	"	extrem	"	"	1.47

1st 17 × 3 × 3⅞

17

17

17

17

17

1 2 5 0

17

3

5 1

3 2

1 0 2

1 5 3

1 6 3

1 5 6

1 2 4

5 4 4

6528.

170
170
160
300

170
80

170
18
716
1143 6.

2734
6126
8874

17 × 6

170
150
130
47

16

24
544
272
3264.

17 — 5/64 4 1/4

1700
564
6800
10200
8500
958800

1700
800
1360000
24
5440000
2720
32640000

138
7

966
138
138

1242

242
~~266~~
~~700~~

69
4

276

18
4

72

368
2000
276

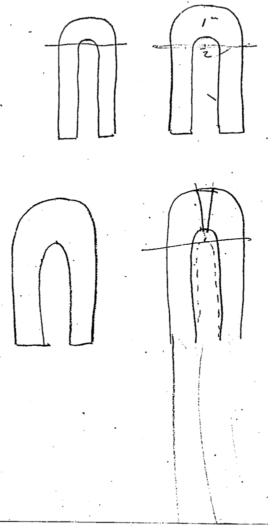
2636

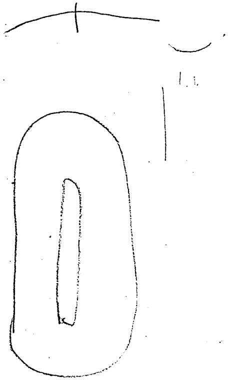
-461

$56.\frac{D}{1000}$ Million

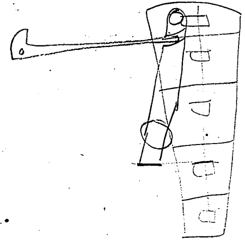
3.

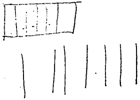
1000
1000
1000000
1000
1,000,000,000

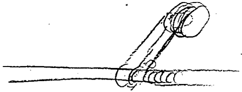




July 12th 1880 returned
25; Small Muffs
not properly Burned







Menlo Park Notebook #106 [N-80-09-28]

This notebook covers the period September 1880-March 1881. Most of the entries are by Charles Batchelor and Alex Welsh. There are also entries by Edison, Francis Upton, and W. A. Mills. The material all relates to the development of the electric lamp and consists primarily of notes and tables relating to lamps that were apparently made at the lamp factory and tested at the laboratory. Included are tests of lamps, made on vacuum pumps during September and October 1880, and resistance tests of lamps for the period November 1880-January 1881. There are also drawings of lamps and vacuum pumps, entries relating to carbon experiments, and a memorandum by Batchelor of things "to be attended to immediately" at the lamp factory. The label on the front cover is marked "Gedney." The book contains 284 numbered pages.

Blank pages not filmed: 54-55, 82-83, 156-187, 190-191, 194-199, 202-203, 206-213, 232-265, 272-275, 278-279.

Missing page numbers: 147-148, 281-282.

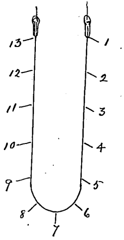
— Explanatory Marks —

Beginning Dec. [redacted]

- • Sent to Edison for experiment.
- ◦ Broken in handling by us.

Sept 28th 1880

Carbon loop - marked for showing position of faults —



Experiments on pumps: Sept 28
1880

1 = Has Contraction 2 mm
Inside fall tube 5 mm
Outside " " 9 mm
Runs through 14¼ lb. Hg per min —
Contraction in this is twisted so that
the Hg strikes the cross tube —

This cracked with the pounding
of the mercury on the 6th Lamp.

Pumps. Sept 28th 1880

No 2		No 3	
Contraction	1.5 mm	Contraction	1.5 mm
inside tube	4 m.m	inside tube	4 mm
outside tube	7 m.m	outside tube	7 mm
Runs through per min	$11\frac{3}{4}$ lb	Runs through per min	15

(Remark:- the contractions of these cannot be right so we will take piece of tubing for contraction)

Pump

4.		5	
Contraction made from tubing with hole 3/4 in long	1.5 mm	Contraction made from tubing hole 1/2 in long	2 · mm
fall tube inside	3.5	inside of fall tube	4
outside fall tube.	9	outside of tube	7
Per Min. Hg.	$17\frac{1}{4}$	Per min –	$23\frac{3}{4}$ cc.

6	7.
Hand made Contraction 2 m m Inside fall tube 4 Outside fall tube 7 per min Hg. 19 3/4 This only run one lamp and fall tube cracked Mercury splashed very much after leaving the Contraction	

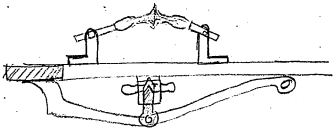
On testers —

	1880 Sept. 29	30	Oct 1	2 4	5	6 7	8	9
Good	16	24	64	11	41	28		41
Bad Spots at	4 6 7 13 4-6 10 12 10 11 2 2-4 6-9-12 8	-2-7- -7-2-12 2-4-12- -4-6-8 1-2-10 -3-7-12 2-6-12 —13 — -7-13- 1-7-13- 1-7-13 -2-13 -6-7-8-	—1— -7-8-13- -2-7-12- —6— —2-12— —2-5— -6-7-12— -2-12- 1-3-6-12 -2-6-9- -2-6-8- -2-9- 3-5	2.6.8 1.9. 6.7.12 6.8.12 2.8.	2 11.12 5 2.4.10.11 4 11 13 1.7.12	1.2.6.7. 13 11.12. 8.9.11. 3.4. 1.2.3.7. 12 5.6.9.11. 2.3.4.10 5.6.10.11. 1 3 5 7 3 4 7 9 8.10.1.2 3.5.9.10		7. 7. 8. 13 1.3.5. 7.8.12. 1.13. 2.5.12 2.4. 3.8. 1.2.7. 11. 13. 3. 12.
Bright on one side	2	1	6-9-11 7-9-12 6-7-10-11 3-6-13-	3		4		4
Bright in middle	1	1	3.7.10 3.6.10 6.8.12.13 —12—	1		5		3
~~Broke~~ Split in Clamp.		1 3	6.8.13.11. 6.13. 3.6. 2-5-11 6-12-	1		6		5
Broke in handling	2	1	—12— —8— 2.8.12. 2.5 12.	1		2		3
Split in fibre			5.13. 2.13. 2. 1.7.12. 9.6.12.					
Badly bent over			6.8. 2. 2.6. 2. 6.8.					
			8.9.13.					

Pumps	Sept 29	30	Oct 1st	2	4,5 inc 6	7	8	9	11	12
Good	22	20	11	25	14	18	15		32	11
Bad Spots	[illegible]			1						
Low Vacuum	[illegible]			1						
Too Bright										
Too Dull			1						1	
Shows Blue all over										
Small Blue arcs.									1	
Busted on pumps	2			1		1			1	1
Leak in Glass				1					7	1
Broke in handling	1	1	1		1		1		1	
Split in Clamp	10	7	6	5	3	5	5		11	9
Bent over				1						
Broke by Hg running up									1	1
Total										

Including Oct 1st

1	6
2	23
3	7
4	5
5	5
6	24
7	15
8	11
9	7
10	7
11	4
12	21
13	13



Lots of lamps as sent up to the Laboratory

Sept 20
Lot 1. To Consist of 159 lamps of Fibres generally not picked but made from the fishing poles we have bought

	Sent
	2
Sept 28.	47
29	30
30	30
Oct 4	30
5	20
	159

Lot No 2.
To Consist of
Carbons made from Bamboo brought by Moore from New York Sept 29th. 1880 bought of Deltour 124 W 3 St
Poles were 8 to 9 ft long.
Joints were 8 to 12 in long for whole length of pole
Diameter about $1\frac{3}{8}$

Color Ripe and yellow —
Moderately thin shell —
very hard surface —
very Clean and smooth inside
the bamboo —
said to be of Chinese wild
growth —
Sent Oct 4 — 33

Lot No 3

Same as lot No 2 only whilst they were on the pumps they were brought up to 70 candles for 2 or 3 seconds

Sent up Oct

Lot No 4

List of different pumps

1	2	3
Inside $3\frac{1}{2}$ mm	— $3\frac{1}{2}$ mm	— $3\frac{1}{2}$ m
outside $6\frac{1}{2}$ m	— $11\frac{1}{2}$	— $6\frac{1}{2}$
Pounds in Vacuum - 10 inch from Contraction	Contract: $1\frac{1}{2}$	Cont.
	Pounds	Pounds $7\frac{1}{2}$
taken off	7 lamps	3 lamps
~~Broke straight across at night~~	Broke straight across fall tube at night	Broke in night on the guage

	4	5	6	7	8
Inside	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
Out	11	11	11	11	11
Cut	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
Pounds	$13\frac{1}{2}$	$12\frac{1}{2}$	10	$10\frac{3}{4}$	$12\frac{1}{4}$

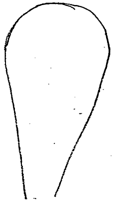
Clamps
Broke in
night in
Fall Tube

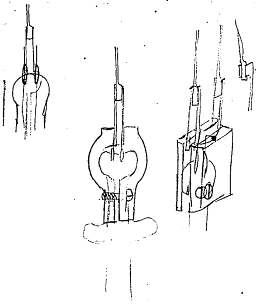
	9	10	11	12	13
Inside diam	3½	3½	3½	3½	3½
Outside diam	6	14	11	11	7
Contraction	2	1½	1½	1½	2
Pounds from cross glass	7	10½	9½	12½	8

	14	15	16	17	18	19	20
Inside	3½	3½	3½	3½	3½	3½	3½
Outside	7	8½	11	6½	6½	10	10
Contraction	2	2	1½	old	old	8½	1½
Pounds	6	11¾	11¾	6	8	6	11½

	21	22	23	24	25	26
Inside	3½	3½	3½	3½	3½	3½
Outside	10	6½	6½	10	6½	6½
Contraction	1½	old	old this has got larger fall tube half way down	1½	old	old
Pounds	13½	9	9	12.	5½m	Pounds
						This fall tube opens out to about $\frac{3}{8}$ inside at ½ way down

27	28	29	30
Inside 3½	Inside 3½		
Outside 6	11		
Cont. old	Ont. 1½		
Short fall tube	Rubber tube on fall tube		
Pounds	Pounds		



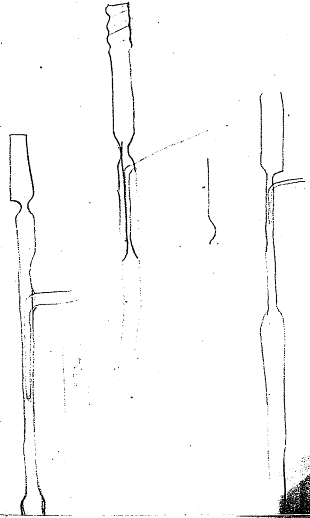


On Testers

	Oct 12	13	14	27	28			
Good	64	15	19.	23	31			
Spots	2. 10 2. 12 6. 8 9. 13. 3 2 2 2 1 1. 3. 2 13. 1 2 1 2 4 all spots	12 1 1. 12. 2 all spots	3 3 6. F.	11 2 12. 11. 3 all spots	6. 2. 1. 13. 8 4 4. ~~1~~ 10 2 3 5 11. 13. 7.			
Bright one side	3			2				
Bright Middle	1	1	1					
Split Clamp.	15	8	1	2	2			
Handling	6	1	1	1	2			
Split fibre								
Bent			1					
By Carriage				1	3.			

Pumps Oct

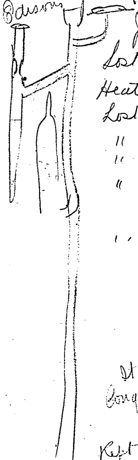
	13	14
Good	4	20
Spots		
Low Vacuum		
Too bright		
Too dull		
Blue all over		
Blue arc		
Bursts	6	2
Leak in Glass	1	1
Handling	2	
Split in Clamps		
Bent		
Hg.	1	



Oct 19th 1880

Put on a Camp on this

Edisons pump time 2.18



Just beginning to run along 2.32

Lost spark at (small coil 4 cells) 3'45

Heated up for instant 3-52

Lost spark heated again 4'05

4'09

" " " " 4'10

" " " " 4'12

" " " " 4'14

4'17

" " " " 4 18

4 19

4:20

4 20

a white [illegible] 4'20

4:21

4-21

4 24

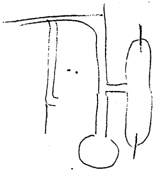
It now has to be heated longer before spark comes ~~longer~~ 4-27

4:29

4:30

4 31

Kept on half min — 4-34



4 37 Kept on half min
4 39 Kept on 1 min
Took off the coil to put on
other pump
4'40 Water for ¼ hour
4 55. no spark when heated
5 oclock Keept the lamp at
~~high heat~~ 25 candles and no
spark
Sparks occasionally
5'10 Current on and no spark
5 18 for 20 minutes

Sealed off and sent
up to Francis

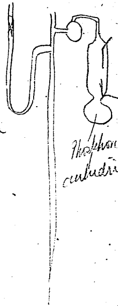
This we make model

Contraction	·020
tube	·090

New pump with drying tube

Put on 442

445 $\frac{1}{8}$ in along wire
447 all along wire
448 all over tube
4·49 from Bluish to Reddish
4·54 Red on one pole & Blue on other



Phosphorus anhydride

To be attended to immediately

Put up the wine cask for tank

Make lead lined chamber for dipping

Make tank wood for same

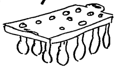
Make Hood and Chimney for same.

Make tank for sprays.

Make tank for water bath.

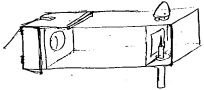
Make 12 lamp holders for dipping

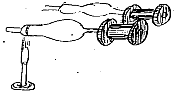
Make racks for drying and holding lamps



Have Winans connect barrel and pump to cistern —

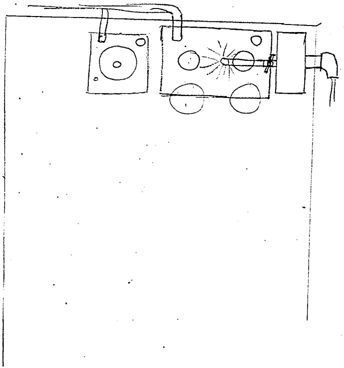
Ditto make spray and flow off water pipe from all tanks.





Carbonization

Fibre	No in Box	One end long	$2\frac{7}{16}$	$2\frac{15}{32}$	$2\frac{1}{2}$	$2\frac{17}{32}$	$2\frac{9}{16}$	$2\frac{19}{32}$	$2\frac{5}{8}$	$\frac{21}{32}$
Bamboo No 1	15	2			1	2	7	2	1	
Bast	16	3			1	1	8	2	1	
Bamboo No 1	16				1	3	9	3		
Bamboo No 1	19	2			5	6	5	1		
Bamboo No 1	17									



Resistance of lamps Nov. 16
before when current on them, cold Bamboo

~~360~~	660
~~270~~	430
~~200~~	360
	2500
	775
	950
	2000
	2000
	2450
	1100
	870
	470
	390
	440
	900
	440

Lot 1. Bast fibre 1 hour
carbonizing 1 hour Nov. 16.

950 in place one broken
750 — 700
700 — 670 after heating in gas flame
700
690
700

Lot 2. Bamboo under same condition as Lot 1 carbonized for five hours

750
650
650
675
675
650

Lot 3
Lamps carbonized in regular wae in 15 minutes and tested and found to be good

※1	700	Ohms
2	1.070	
3	980	
4	1000	
5	625	
6	650	
7	1020	
8	760	
9	2400	✓
10	640	
11	525	✓
12	675	

Lot 2

#	
13	740
14	950
15	450 ✓
16	1200 ✓
17	750
18	1150
19	1050
20	870
21	900
22	680
23	580
24	610
25	600
26	950
27	750
28	780
29	650
30	900

Nov. 15

Exp When carbon heated gas flame resistance lowered —

Pt Lamps	765	Ohms
Ni "	765	

warmed in gas flame — 10 to 15 Ohms less

Bast fiber

Marked 675 cold

marked 680 cold

Reg 1 3
900 - 710 - 500

Test of 7 Bast fibres thick ends
Carbonized slowly 3 hours

560
460
500
510
460
460
510

Old lot.

no			
1	670 ohms	24	860
2	1000	25	470
3	1000	26	520
4 —	729	27	770
5 —	1100	28	775
6 —	770	29	775
7 —	1070	30	480
8 —	650	31	530
9 —	770	32	520
10 —	1170	33	1000
11 —	750	34	800
12 —	1150	35	577
13	1100	36	430
14	910	37	2700
15	910	38	650
16	510	39	470
17	620	40	590
18	950	41	950
19	800	42	627
20	750	43	530
21	975	44	453
22	580	45	2500
23	810		

~~[illegible]~~

Experiment on 10 bamboo

Carbonized the old way

of the [illegible] [illegible]

taken from [illegible]

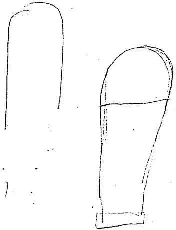
weighed [illegible]

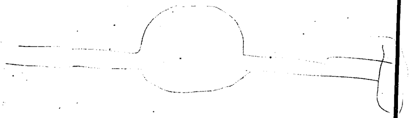
Dr Moses

1 — 1027 ✓
2 — 970 ✓
3 — 1100 ✓
4 — 360
5 — 725
6. 2000 ✓
7 — 810
8. 975 ✓
9 620
10. 2400 ✓

Carbonization of 10 bamboo
1 hours - taking 6 of
the lowest & sending
to be weighed in Dr
Haid or Moses

1. 850
2. 600 —✓
3. 710
4. [illegible] —✓
5. 650 —✓
6. [illegible] —✓
7. 750
8. 650 —✓
9. 570 —✓
10. [illegible]70





November 17 1880

TAE

Chas Batchelor

Vacuum by heating Carbonized material and Carbon in ~~glass~~ bulb - Stop-cock at each end of Carbon bulb - one end open on other end lamp. Heat the carbon bulb with open end close end Stop-cock and open one leading to lamp

Nov. 20, 1880

Variations in resistance before & after placing on pumps.

Before 345 } 161
After 184 }

D. – 508 } 317
D. – 191 }

445 } 278
167 }

491 } 309
182 }

455 } 238
217 }

508 } 306
202 }

466 } 251
175 }

167
184
191
180
175
202
217

Alex. Welsh

Nov. 17th '80.

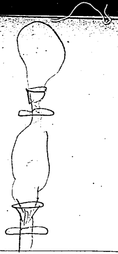
Experiment to determine difference in weight between high & low resistance:—

6 Bamboo car'd old way, high test
Wt. = ,031.7 Gr. = 31 7/10 Milligrammes

6 Bamboo car'd one from Low resistance
Wt. ,034 Gr. = 34 Milligrammes

The above were selected from out of ten of each class being the six (6) highest & 6 lowest resistance of their respective lots.—

Alex Welsh



Resistances compared with Lamps

500	365 Ohms
505	357.5
510	350.5
525	330
549 1/4	300
595	250
649	200
713 3/4	150

493	375
476 1/4	400
446 1/2	450
420 1/2	500
397	~~600~~ 550
376 —	600
340 —	700
263 —	1000
330	730

16.7 : 16 ::

1.8

144

~~288~~ : 25 : ~~16~~

18) 25 (14 candles
18
70

10.8
10.8
864
108
116.64

18
18
144
18
324
116.6
4406 (21
4
41) 40

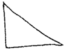
3738
3907

14 candles
16 candles

10.8
18.
~~8~~28.8
9.6
19.2

21
19.2
1.8

8
125
8.3
16.7



17
17
119
17
289
64
353 (18.7
1
28) 253
224
36) 2900

2.

14.581
21.311

3907)33000(8.44
31 248
17520
15628
18920

7/3738
534
4272)33000(7.7
29734
32660

Lamps

6" X .017 X .008

Average 16.7/1000
Diameter 18.7/1000 2.

6" X .017 X .0108

Average 19.2/1000
Diameter 21./1000 1.8

.012.5 X .012.5 X 6"

Average 16.7/1000
Diameter 17.8/1000 .9

Lamp .17
8

$\frac{2}{3} \times 25 = 16.7$

$\sqrt{17^2 + 8^2} = \sqrt{353} = 18.7$

$\sqrt{18 + 10.8} = \sqrt{440.6} = .21$

$\frac{2}{3} \times 28.8 = 19.2$

16.7 : 18.7

12.5
12.5
156.25 Diameter
2
312.5

16.7 average
17.6 Square

2 - 36 - 25
2 34 10
2 - 15

120
15
135

2 - 38
36 55
1 5

65

2 - 41 - 15
39 40
1 35
195
47

Pump 2

2 - 33 - 40 Spark stopped

2 - 34 - 10 10 seconds of current

2 - 36 - 25 spark off

2 - 36 - 55 10 seconds of current

2 - 36 — 8

2 - 39 - 40 20 seconds

2 - ~~41~~ - 15

43 - 25
41 - 40
1 45
105
52

2—41—40 20 seconds

2-43—25 8.0

2 45 - 30 8.0

2—46 30 sec

2-48 2.0.

2-48-20 30 sec

2-50-20

2-50-30 1 minute

2-53-45 [illegible]

Nov. 21st/80.

Experiment made to determine whether length of carbon in any way effected resistance,

Length	2 7/16	2 15/32	2 1/2	2 17/32	2 9/16	2 19/32
	462	443	620	710	670	365
	330	484	585	658	512	
	661	395	390	613	500	
		454	457	730		
		473	547	730		
		387	645	478		
		513	595	374		
		330	555	662		
			575	534		
			545			
	1453	3479	5514	5479	1682	365
G. Avg	484 1/3	434 7/8	551 2/5	608 7/9	560 2/3	365

Alex. Welsh

Nov 22nd 1880

Carbon loops

From this date we call the "regular loop" a Bast fibre cut 10 x 14 thousandths. Put on lamps of this kind "Regular" "Date" and Resistance

Car^d 5 hour Chas. Batchelor

11/26/80.

" Five @ hour Bacr low to regular

- 397 — Brok
- 420 out
- 443 out
- 337 brok.
- 440 out
- 357
- 433 out
- 474 out
- 372 Brok.
- 446 out

Lot 8 17

- 375
- 376
- 398
- 395
- 348 Vol. Sealed in
- 484 out
- 377

\# 3 Bamboo 3 hr.

12^00 over
1200 "
1200 "
1200 "

\# 4 Bamboo 4 hr

1000 over
" "

Boar "Regular"

4 #1 Bamboo one @ hour heat very slow

1200 over
1200 "
1200 "
1200 "

\# 2 Do 2 hr Do

1000 over
1000 "
1000 "

1.2.3 & 4 taken out of clamps

Lot 14 – Bast Car'd 8½ hrs Nov. 25/80.
606 Carbon'd 8½ hrs. – 7 hrs Black
661 heat, 1 hr from Black to Bright red
453 ½ hr from B.R. to regular heat.
395
510 (Taken out) A.W.
481.

Nov, 26/80

Bamboo 10×17 5 Hours.
Brot up very [illegible]

375
396
413
358
385 all sealed in and sent up to Laby
375
348
386
404
368

Alex. Welsh

Nov. 27/80.

Bast 10×17 – 5 hrs.
292
315
296

1 Paper 9×17 – 5 hrs
about 850 sealed in and sent to Laby 11/29/80.

Lot of 19 "Regular" Bast

440
408
421
428 Taken out.
560
415
483
402
473
516
503
467
474
448
455

11/29/80.

Lot #3 – Bast fibre 10x17. Having no pith seams. 5 hr. Car'n. for further reference see Van Cleve's Book p. 29.

Resistance

·285
·266
·260
·251
·289
·300
·307
·272
·257
·300

In Box

Alex. Welsh

Lot #2 #0 11/29/80

Bast 10x17 – 5 hrs. (See Book (Bradley's) p. 28)

Resistance – 268. 289. 262. (B in Hand'g) 347. 317. 335. 307. 325. 314. 311. 325. 289. 284. 307. 293. 287. 278.

To be kept separate.

Alex. Welsh

11/29. 80.

Lot #12

#1 Solid Bamboo Cane (new stock) 8x17 – 5 hrs (See Bradley's Book p. 32)

Resistance – 344. 338. 324. 324. 330. 319 312

down stairs

Alex. Welsh

Lot #1 #2 – 5 fibres 11/30/80

Bast (See Bradley's book p. 27)

Resistances – 290. 278. 250. 280. 288.

Alex. Welsh

Lot #7 #3 11/30/80

Paper 9x17 (see Bradley's book p. 31)

745. 750. 699. 805. 720. 820. 702. 632. 781. 781

Alex. Welsh

11/30/80.

Lot #13 Bamboo 8x17 – cut from new stock. peculiar kind of Bamboo (See Bradley's book p 33)

This stock took very good — 11 fibres

Resistances: – 377. 347. 352. 395. 382. 336. 359. 337.

11 Alex Welsh

Lot of 19 — 11/30/80.

Bamboo 8x17 – 5 hrs. regular

Resistances: – 377 – 350. 508. 380. 359. 383. 392. 346. 335. 390. 378. 345. 340. 383. 353.

14 Alex Welsh

11/30/80

Lot of 18 – Bamboo 8x17 – 5 hrs regular

Resistances: – 487. 445. 438. 436. 404. 439. 485 405. 492. 481. 481. 447. 435. 435. 493. 457.

Alex Welsh

#H — 13 Ps

12/1/80.

Lot of 16 Bamboo 8x17 – 5 hrs.

Resis: 289. 278. 312. 292. 289. 294. 301. 276. 285 300. 286. 274. 296. — O.K.

13 Alex Welsh

Dec 1st 1880

The lamps made for Laboratory from this date will be Bamboo – 8x17 thousandths – 5 hours Carbonization – and will be numbered consecutively commencing at 1.

All will be under 400 ohms resistance when cold —

– Platinum clamps. —

Chas Batchelor

#5 Dec 1st 1880 12/1/80.

Bamboo 8x17 - 6 hrs.

Resis's: - 290. 267. 280. 294. 261. 289. 275. 297
313. 320. 307. 282. 309. 283. 272. 284

down stairs Alex. Welch

Lot 18 - 18 fibres Dec 1st 1880 12/1/80.

#6 Bamboo one half size of original fibre ⊏—3½—⊐ made from the best of the Tall Bamboo (See Bradley's p. 37)

110. 164. 125. 85. 194. 125. 138. 126. 110. (Cont'd p. 129.)

Alex. Welch

Dec 1st

#7. "Taper." 5 12/1/80

Bamboo 8x17 small piece cut out of each ½ in away from the beginning of the round ¼ in long reducing same to 14/1000

See Bradley's book p. 37

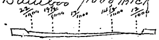
Resis = 358. 350. "Sealed in and sent to Lab'y"

Alex. Welch

Dec 1st 12/1/80

#8 5 - 5 hrs

5 Bamboo 8/1000 Thick Tapering Thus (See Book p. 39 Bdy's)



Resis's: - 309. 305. 313. 305. 318 (Sent to Lab'y)

Alex. Welch

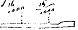
12/2/80

19 Bamboo 8×17 5 hrs.
Resis^s. 283. 295. 325. 257. 284. 360. 290.
296. 285. 281. 291. 295. 274. 260. 296

Alex. Welch

Dec: 2^d 1880.

Tart Bamboo 8/1000 thick, Tapering as follows:



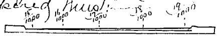
Resis: — 264. 270.

(Dd^t 12/2/80 —)

Alex. Welch

Dec. 2^d 1880.

3 Bamboos from stock same as last lot of same size & 8/1000 thick
Tapered thus:



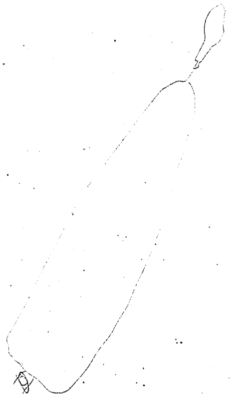
Resistances: 287. 289. 325.

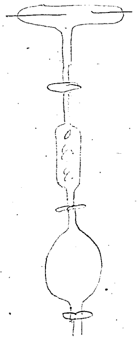
Alex. Welch

Dec. 3^d 1880.

Bamboo 8×17 — 35/1000 thick & 62½/1000 wide on ends from best of last lot — regular length
There is one of them 1/2/1000 small on one end.
Resis^s. 407. 305 267. 261. 261.

— See p. 125 —





Order

Make a mould full Reg
Bamboo & horn reg heat.

also mould full. same using
Iron mould and going up to
Safe final temperature.

The carbons are to be numbered
or called. Nickel Mould Reg
and Iron Mould Reg

They are to be tested for
Resistance & put in lamps.
& Res marked on each lamp

afterwards they are to have
their Res measured at 16 Candles
to determine if the heat ~~attainable~~
with Iron Mould ~~is sufficient~~.)
The final Res at 16 C of both lots shows
the measure of Iron higher than its N.G.

3d Quality
2d Grade

Dec. 7th '80.—

Bamboo fibre. This is the poorest looking specially selecting to find out whether the dark stains in [illegible] of the wood being mouldy [illegible] [illegible] injurious to the fibre for carbonization purposes
(See Bradley's Book, p. 40)

1st — 28?. 258. 240. 289. 252. 260. 276. 264. 27?. 260
2d — 240. 246. 283. = Gen. Avg. 263 10/13

2d 272. 255. 253. 270. 267. 270. 263. 261
256. 245. 259. 244. 25?. 266. Gen. Avg. 262 ?/17

Alex. Welsh

Dec. 7th '80.—

Lot # [illegible] — Bach [illegible] [illegible] 10 × 17
5 fibres
See Book (Bradley's p. 30)

Resist.s 292. 292. 280.

Alex. Welsh

Dec. 7th '80

Lot # 2 — Bach 10 × 17 (See Bradley's book p. 28)
7 fibres

Resist.s: 285. 231. 265. 299. 265. 276 G. A. 270 ?/6

Alex. Welsh

Dec. 8th 80. —

"Bamboo 8x1" specially selected from the best of the last lot or so called Ton of Bamboo"

Query:— "To determine whether there is any difference between the so called worst and the so called best stocks".

"Would like to know all about this at the earliest possible moment"? See Bradley's bk p. 41

"B." Carbon color very clear supposed to be the best."

For resistance see p. 133. —

[illegible]

Dec. 8th 80. —

Bamboo 8x1" cut from new stock. Special sampling party — (See Bradley's book p. 42

Resis. 270. 264. 292. 256. 276. 264. 253. 256.
280? Av. 265?

[illegible]

Dec. 8/80.

Bamboo 2 sizes (cont'd of p. 117)

Lot recd. this day Resis:- 195. 185. 165. 184.

171. 165. — Av. 178. Alex Welch.

Dec. 9/80.

Bamboo 2 sizes (Cont'd from above)

Resis: 104. 118. 110. 104. 118. 110. 104. 101 —

Av. 108 5/8. Alex Welch

Dec. 9th 1880. —

Special lot of Regular cont'd of p. 127.

Resis: 256. 211. 221. 236. 212. 218. 222. 222

224. 248. 213. 224. 223. 236. 231.

236. 236. 227. 209. 230. 236. 222.

Av. 227 3/22 Alex Welch.

Dec. 13/80

Rec'd of Mr. Edison's hands

(1) "Regular" 2 in R. 70

1 " 1/2 " " 60

Alex Welch

Dec. 8th 1880

Do not use any "regular" carbons, hereafter of over 300 Ohms' resistance as directed by Mess. Edison & Batchelor this day. —

Alex. Welsh

Dec. 9th 1880.

Directed by Mr. Edison to take out all _best_ carbons from inside parts as he does not want same.

Alex. Welsh

Dec. 9th 1880.

Rambler 417 Decimal (Rep. 127)

Merino

256	267	325
280	234	285
327	214	286
2[illegible]7	245	255
318	264	305
288	239	286
27[illegible]	304	315
308	231	331
300	272	331
265	204	2719
200	278	
250	331	
27[illegible]	270	
28[illegible]		
218	209	
290	293	
288	286	
230	327	
292	310	
252	278	
24[illegible]	240	
2[illegible]0	211	
245	347	
265	278	
248	288	
24[illegible]	288	
23[illegible]	356	
236	295	
289	365	
329	312	
8161	8050	

Totals 8161
8050
2719

67) 18930 ($282\frac{36}{67}$ G.T.

Alex. Veitch

12/15/80

From this day all regular carbons are to be ~~distinguished~~ as follows. 9. 13 C D
6 in – 3 – 2 . 1½ by direction of Mr. Batchelor.

Alex Welsh

Jan. 4th '81.

Bamboo "Reg" ½ size treated with carbolic acid under cover of box. (3 hr. heat.)

Resis.s 256. 254. 254. 460. 245. 245. 245
218. 218. 218. 190.

Alex. Welsh

" Jan. 1 '81.

Resis. of Bamboo "Regulars" carbon'd in Ashes.

566. 675. 570. 384. 390. 589. 589. 730. 604
604. 685. 628. 760. 760. 368. 441. 417.
377. 412. 369. 510 } 635.

Alex. Welsh

Jan. 1/81 —

A "Regular" carbon for the present is a fibre carbonized for 3 hrs. made without stop of Bamboo 8x17 —

Alex. Welsh

Jan. 5/81 —

Platinized loops.

Resis.: 570. 825. 640. & 690

Alex. Welsh

"A" Jan. 5/81 —

Bamboo 8x17 - 3 hrs. heat — Treated with carbolic acid under cover of iron box.
nine minutes stop.

Resis:— 570. 500. 510. 426. 430. 426. 445. 443. 570. 525. 443. 500. 500 & 500

Alex Welsh

Jan. 5/81 —

Bamboo "A" treated with ashes regular heat 3 hrs. no stop.

Resis.: 335. 325. 261. 261. 260. 268. 267. 265. 260. 267. 294. 245. 289

Alex. Welsh

Jan. 6/81

Reg. "B" Carbons treated with carbolic acid under cover of iron box —
Resis: 256. 254. 254. 245. 245. 245. 218. 218. 218. 190. —

Alex. Welsh

1/7/81 —

No. 6 — Shellac in "Lawson"
2 Reg. "A" 4 hrs. 8x17 — Resis under 300 —

Alex Welsh

1/8/81. —

1. 4 New style clamps. Carbons "reg" below 300.
1/6/81. 3 P.M. placed in circuit
1/7/81. 10 P.M. Taken out. A.K.

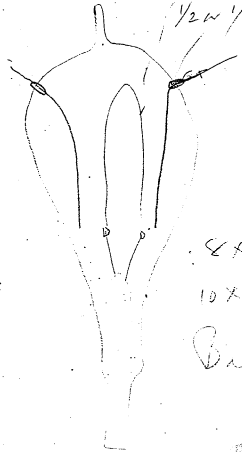
2 3 Do. — " " .. 300
1/8/81. Placed in solution 11:30 am
1/10/81 Taken out 9 —

1/8/81. Alex Welsh

Experiments in clamping platina wires to carbon by means of electric deposition. The leading wires the leading wires as far as the carbon tips ought to be cleaned by means of heat before being sealed in lamps

Alex Welsh.

1/2 w 1/4 from [illegible]



8 x 17

10 x 17

B[illegible]

Lot # 3 1/18/81.

New style clamping.

1/16/81. Placed in solution 8 P.M.

1/17/81. Taken out 1:30 P.M.

Alex Welch

1/18/81.

Lot # 4-1 Spiral Cu

" 5-7 B's Ag.

Alex Welch

1/19/81.

Lot # 6 - 4 "B"s Cu Bk. 1 p. 11

7-1-Spiral "G" " " 1 " (20)

9-1- " " " " 1. (20)

8-(6) B. Ag.

10-(4) " Cu (Broke taking out heater. See Lawson) } " 1 p. 12

1/19/81. All new style clamping to be heated at about 175°F. 1/2 hour to dry same. Lawson

2 As Stard. Loops R. 1/19/81

See Lawson's book! p.3

11 1 Spiral Cu. Bk. 1 p. 12 1/20/81.

12 - 5 B. Ag } Bk. 1 p. 13 1/20/81.
13 - 4 " Cu

1/19/81.

Order No. 46 – 12 – Car. R. 299.334.312.300.
299.289.283.285.308
283.325 – G.A. 303 4/11

" " 105 – 5 Car. R. 337.328.323.325 – 278

" No. 45 – 10 Car. R. 267.254.233.262.293.290
278.282.296.299 – 275 2/5

" " 107 – 8 Car. R. 426.429.469.462.500

1/21/81 " No. 43.7.Car "A". R. 302.267.296.274.289.299
267

" " 115.8. Car "A" R 334.350.350 – 325 – 365
340, 352, 337

" " 123 11 " "A" R 295 – 312 – 312 – 300
295 – 290 – 315 – 310
305 – 300 – 305

" " 44.13 " "A". R. 300 – 310 – 290 – 280
275 – 270 – 285 – 295
280 – 285 – 275 – 300
295.

1/22/81

" " 124.15 " "A". R. 245 – 290 – 250 – 255
280 – 245 – 250 – 255
275 – 255 – 240 – 230.
260 – 275 – 280

" " 125 5 " A. R. 350.330.355.360.350

" " 120 1 " "A". R 480

" " 139 7 " A. R 175 – 182 – 230 – 210 – 185
190 – 210

1/22/81 in double clamper

Order No 117 – 4 car R 120-125-120-120.

1/24/81

Order No " 126 – 3 car R 300-285-290

" " " 127 – 2 car R 410-480

" " " 44 – 6 car R 290-230-250-280 245-275.

" " " 47 – 5 car R 235-225-210-225-225

" " " 48 – 8 car R 270-275-300-270 280-290-285-275

1/25/81

Order No 128 – 9 car R 260-255-250-255 270-B/125-120-120-130

" " 32 – 13 car R 315-310-275-280 295-260-290-290-290 290-295-280 295.

" " 126 – 2 car R 290-256

" " 32 – 14 car R 275. 265-315-290 288-290. 295-275-310 295-290-280-285-280

" " 131 – 5 car R 405-385-370-380-375

" " 133 – 6 car R 340-325-310-230 300-295

1/25/81

Order No 133. 14 car R. 565-520-525-670-730-735-700-725 590-590-565-600 590-620.

Order No 138 6 car R 300-295-285-290 315-300.

" " 137 4 car R 310-360-340-345

1/26/81

" " 139 6 car R 410-420-400-450-440-415

" " 143 5 car R 410-420-390-375-410

" " 144 5 car R 310-340-305-330-290

" " 144 13 car R 270-290-250-270 260-295-230-275 290-285-225-240 230.

1/27/81

" " 132 15 car R 220-208-245-210-220 255-210-270-250-210 230-250-270-245-270.

1/28/81

" " 153 33 car R 120-125-115-120-135-125-135-120-115-120-130-120-115 145-125-120-125-135-120-115 125-120-130-110-130-125-115 110-130-120-120-115-125.

1/31/81

Order No 140 R 12a

245-255-230-235-270
250-260-255-240-270
260-250.

Order No 141 R 6a

245-240-245-240
245-240.

Order No 39 R 10a

295-290-310-325-~~320~~ 285-
296-326-305-325-335

Order No 40 R 13a

380-350-315-310.325.320
310-340-325 330.345.360
345.

Order No 145 R 2a

325-300

Order No 141 R 7a

285-300-295-285-295-295
280

Order No 133 R 12a

250-270-260-255-250
220-235-240-260-270
240. 270.

Feb 1/81

Order No 37 12 bar

200-200-230 235-200
225-230-205-200-230
205-195

Feb 1/81

Order No 156 9 bar

376-380-390-350-365
410-340-385-400

" " 146 10 bar

265-280-280-260-270
275-280-275-265-290

" " 133-13 bar

168-175-170-195-180-180
170-225-195-205-185-180
215

Feb 2/81

Order No 166-38 bar R

155-150-150-175-155-155
150-170-150-150-160-165-150
170-145-162-130-135-152-165
170-165-160-165-160-168-175
165-175-165-150-160-155-165
140-145

" " 166 26 3 bar R

195-170-185-180-175-170
165-160-175-165-190-180
175-155-170-165-150-165
175-175-160-195-170-180
165-150.

" " 156 13 A bar R

545-520-485-550-445
570-410-575-445-570
510-490-475

" " 156 17 A bar R

480-520-545-440-550-500
500-520-542-420-445-420
360-400-475

" " 35 13 A bar R

350-345-360-210-190
335-315-325-325-340
315-315-325

Feb 2/81

Order No 35. 5A. R
265-245-235-230-215

" " 33 / 11 A R
240-235-245-220-195-230
235-195-235-215-230

" " 33 11A R
195-205-200-205-195
225-195-210-180-195
190

Feb 3/81

Order No 36 12 A car
255-240-250-245-240
230-245-245-230-220
240-245.

" " 33 9A car
205-205-200-200-210
205-200-205-200

" " 35 7A car
325-315-330-325-335
310-305

" " 192 11A car
200-210-205-200
210-195-195-205
200-215-205.

" " 39 10 car
225-230-240-235
205-245-245-225
210-255-192.

" " 192 4 car
210 215-195-200

Feb 3/81

Order No 39 R 2 car
270-275

" " 40 13 car R
235-220-240-230-249
230-230-225-230-245
235-230-220.

" " 33 4 car R
215-190-225-220

" " 39 7 car R
248-245-195-256-245
240-245.

" " 192 5 car R
205-200-236-205-205

" " 192 20 car R
350-350-350-335-340
350-365-345-385-360
350-355-365-345-360
355-340-365-350-355

" " 192 16 car R
300-305-320-345-330
325-320-315-330-340
330-325-340-345-360
355

Feb 7/81

" " 198 R 15 car
540-612-580-560-600-585-550-490
565-550-615-590-560-575-585

" " 192 R 15 car
670-900-1000-820-650-825-650-710
685-670-1000-950-700-650-850.

" " 192 R 16 car
280-260-245-255-730-295
260-285-265-230-260-290
280-267-260-280.

Feb 7/81

Order No 1981 7 car R

600-590-570-585-560
565-575-550-560-590
710-720-705-730-650
675-670.

" " 198 14 car R

395-380-800-430-450-445
435-730-430-460-550
575-560-576.

" " 198 14 car R

650-370-410-500-420
460-475-550-570-585
610-630-620-605

Order

Total Amt of Carbons Tested 711

March 24. 1881,

Cost Pt. wires

1 lb 3 dwt cost \$ 94.94
Express charge 7.80
\$102.74

It made 12,000)10274

2 (~~12000~~ 6000) 102.74 (1
1.7 cts per lamp

FRUpton

Nov 27, 1880

Tested No 1 Bamboo carbon in Iron clamp, and afterward in Platinum clamp and found no difference in resistance.

Tested No 1 Bamboo carbon in Nickel clamp, and afterward in Platinum clamp and found no difference in resist.

We find that carbons that have been tested and allowed to stand a few days always test higher. The difference in resist we think is the result of atmospheric action on carbon

W. H. Mills

1/24/81

Order

135 Lamps with platinum clamps and plated carbons.

136 Lamps with Platinum clamps and unplated carbons.

158 Lamps with silver clamps and unplated carbons

Lot of 17 - Regulars

Resistances in full of different Lots "A"

Lot No	1			2			3		
1881 Jany	12			12			12		
	Cold	Hot	Remarks	Cold	Hot	Remarks			
	249			377			341		
	319			354			402		
	285			297			418		
	332			315			283		
	294			336			300		
	293			414			304		
	291			366			329		
	377			391			218		
	336			372			259		
	254			376			293		
	282			273			331		
	292			378			251		
	303						305		
	340		300 [illegible]	296		349 [illegible]/15	209		
				382			216		
							236		
							208		288 [illegible]/17

1881.

Lot No	1			2			3			Lot No. 29					
Jan'y	12														
	Cold	Hot	Remarks												
	249			377			341			329			341		
	319			354			402			285			365		
	285			297			418			267			329		331 1/2
	332			315			283			302					
	294			336			300			343					
	293			414			304			336					
	291			366			329			329					
	377			391			218			344					
	336			372			259			303					
	254			376			293			350					
	282			273			331			360					
	292			378			267			363					
	303			296			306			336					
	340		[illegible]	382			209			343					
				312		349 4/15	216			311					
							236			362					
							208		288 4/17	303					
										394					
										380					
										359					
										302					

4	5	6	7	8
297	270	311	232	251
241	327	297	245	325
260	302	254	250	339
245	322	293	213	266
196	299	283	213	233
237	260	281	209	263
261	329	280	227	265
217	248	240	229	257
234	276	264	291	289
203	293	262	232	257
251	322	318	245	244
217	305	246	212	269
205	349	265	241	232
207		294	208	275
240		268	205	289
201		278	240	277
				233
				253

9	10	11	Mis.s lot	12
243	255	278	289	232
272	270	306	291	316
289	288	331	270	245
246	259	327	267	245
292	331	397	289	227
309	240	365	267	268
262	250	304	256	223
295	267	349	221	268
238	323	326	267	229
295	251	336		259
249	244	324		239
264	267	310		244
336	223	317		260
291	251	339		289
255	250	299		259
348	242			220
260	275			246
	288			236
				248

17	358, 367, 343, 403, 362, 381, 374, 338, 491, 327, 420, 427, 360, 420
16	224, 268, 276, 261, 235, 256, 265, 259, 257, 264, 240, 243, 249, 265, 243
15	261, 225, 226, 267, 199, 257, 263, 264, 250, 224, 207, 196, 294
14	289, 260, 277, 239, 277, 259, 242, 234, 241, 219, 223, 236
13	232, 241, 232, 263, 223, 257, 245, 280, 236, 254, 312, 346, 267

18	19	20	Total 21 As	21
344	316	350	535	331
327	311	358	635	378
322	327	377	625	306
339	366	393	790	343
385	347	418	248	346
346	339	359	724	392
342	358	374	764	337
361		416	226	365
310		403	706	373
405		463	658	388
296		337	775	280
388		398	690	365
423		391	234	395
299		395	766	371
334		360	354	376
283		350	379	392
			615	
			207	
			514	
			251	

22	23	24	25	26
335	294	441	280	326
329	304	383	296	312
300	279	387	280	318
335	304	362	298	332
369	317	387	288	426
403	315	481	279	310
332	312	481	249	291
344	323	434	248	310
330	283	464	325	260
299	317	520	301	365
350	309	372	278	335
337	316	380	280	335
294	303	418	243	293
291		428	248	311
		431	257	295
				266

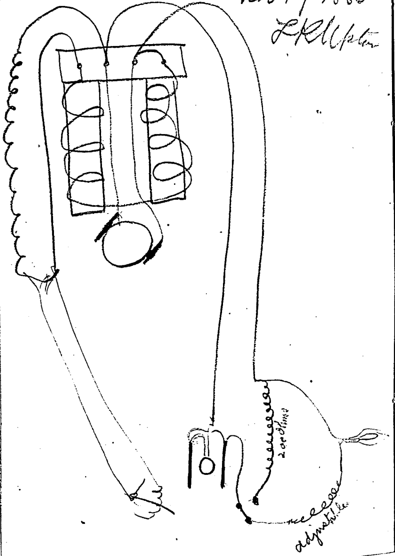
27	28	29	30	31
426	443	358	270	241
417	376	261	274	251
381	408	262	299	252
384	284	232	256	227
411	393	363	272	256
339	410	236	222	236
381	248	261	236	213
376	405	234	267	223
380	435	214	254	227
365	290	362	244	234
510	491	206	259	227
382	373	249	271	
363	431	245	256	
443	443	242	232	
360	349		264	
639	372		297	
			232	
357	391	237 [illegible]	219 9/17	235

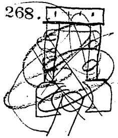
32		33	34	1(a)	5
218		380	325	29.9	214
215		230	244	300	223
232		242	331	286	211
191		209	252	320	222
236		267	265	323	206
233		256	265	299	209
238		278	294	289	218
209		261	332	312	241
267		213	241		216
198		256	261		216
278		289	249		200
209	225 3/4	227	319		230
		241	282		200
		236	246		202
			289		209
			273		218
			234		218
					210

6	7
349	306
227	278
245	272
218	290
210	269
230	299
264	261
200	265
223	283
238	289
238	277
253	270
209	267
245	231
225	258
264	278

Nov 17 1880

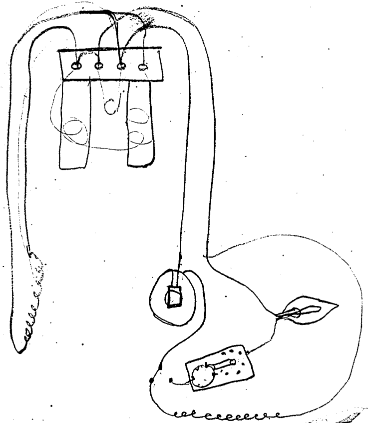
FR Upton

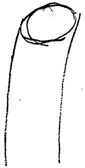




Nov 17 1880

F. R. Upton





$$\frac{1000}{\;\;127\;\;}$$
883

~~127~~

117

$$\frac{117}{7024}$$

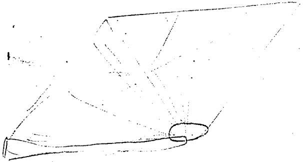
117 : 883 : 1000 : x

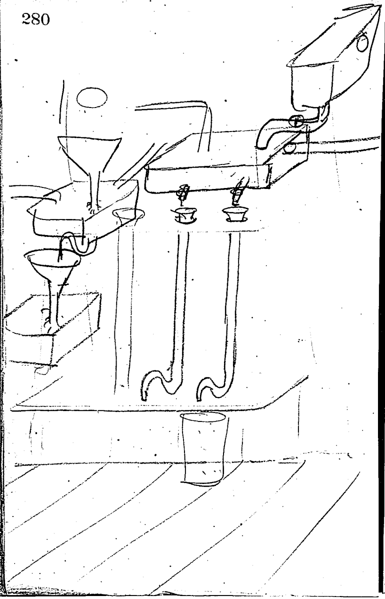
117 | 8830.0 | 754
819
640
585
550

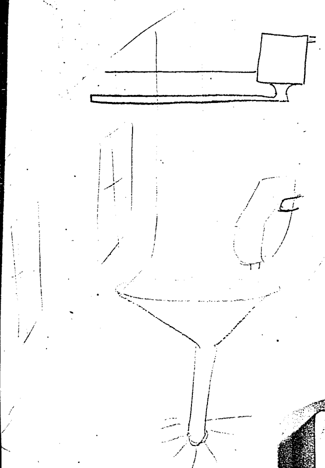
$$\frac{1000}{117}$$
883

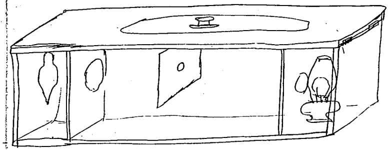
117 : 883 : 101

117 | 8830 | 75
819
640
585
5





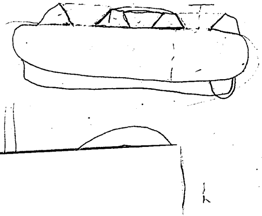




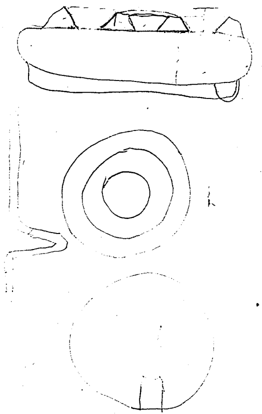
Menlo Park Notebook #107 [N-80-04-02]

The entries in this notebook contain only the month and the day. The book probably covers the period April 1880-January 1881. Its author is unknown. Included are notes relating to tests of insulating materials, primarily glass, quartz, and calcite; notes on magnetism experiments; and notes on chemical experiments. There are also a few drawings of circuits. The label on the front cover is marked "107" and "Apr 1880." The pages are unnumbered, and the book has been used in both directions. Approximately 100 pages have been used.

apr 1880?



apr 1880?



Times, 2 min charging
1 " till discharge

Max. of each, dis. read

(1) Glass = Green plate
(2) " = White "
(3) " = Window glass
(4) " = Guttapercha
(5) " = Gold
6 " = Polariscope

Lead Electrode

Quartz = 18.20 L = Eyepiece
Opt @ 5 rt. = +5
Recedes very fast after reaching away in case of Glass(1)

Elec. Abs. Dec. 4

Diel	1st Time	2nd "	3rd "	
Glass (1)	-85	-70	-55	Elec. +.22
" 1	-40	-65	-47	" +.15
	-21	-38	-16	" +28 1st contact longer
Glass (2)	-35	-30	-15	+20
	-38	-33	-31	+30
	-42	-44	-30	+28
Glass (3)	-40	-33		+20
	-45	-33		+20
" (5)	-30	-24		+18
Glass (2)	-62	-40		+16
	-35	-29		+12
Glass (1)	-43	-28		+40

The residual discharge of Qtz – natural, singular, [illegible]

Glass as before

Ch 2 Min

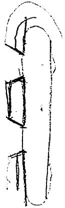
Interval 30 Seconds.

Plates in evaporator over Sulfuric acid, disch. very fast.

Ch. about the max. that can be attained

Shot up to 60, many back & they reached 50

	Dec 8 1	2	
Qtz. (1)	40.	20	+ 30
	45	20	+ 30
Glass do	220	60	–
	160	50	– 15
	115	85	– 30
Selenite (1)	45	38	– 30
	85	55	– 22
	72	40	– 30
Glass Sensitized			
	35	30	
	~~50~~ 4	35	
	110	60.	
Qtz "	55	57	Failed
	130	–	–



— April 2 — Res. Sch. Exp

Process.

Battery 6. Leyden Jars —
Charged 3 sparks. — {Hansteen's Jar
after 20 Seconds, } [illegible]
momentary charge of plate. Then discharge
& contact with [illegible] five
seconds, — Electrometer [illegible] after 10 Sec
& total, —

No	10 Sec	Total		
1	80.	80.	?	
2	100, —	—	—	? —
3	35	35	—	—
4	38	40	— (No discrepancy	
5	— 70	—	—	— !!!
6	120	24	— — —	
7	— 78	— 18	—	— —

5 Sparks

No.	10 Sec.	total	
1	75	75	No increase
2 l	−40	−40	"
3	+58	—	—
4	−25	—	—

5 Sec. Contact

r + 155, — leakage
l − 64 — —
l − 135 — —
10 Sec Interval, 5 Sec Contact

r +60
r +99
l −82
l −78
r +55
r ——

~~After~~ 15-Sec. Interval, 10 Sec Contact, — Opt. +.4

	10 Sec	Increases !!!
r	35	63,
l	110,	130
r	80	85

Handle, — already on r or l,
r Total 115
l — 70 — (Induction defl to +70
r Total scale ——
r 111 (Ind. defl to −65
l 135 (" " +100
l 50 " " +120

Same Ind 50

l		−36 = Total
l	——	−70
r		+90
r		+175

l 140
r 119
l 155.
r 130
174
r 177
l 176
r 181
l 165

Same. — viz. —

l 173

Apr. 7 —

Glass(a) —
Intervals, 5, sec, contact
5 sec earth
5 sec insulated
then Electrometer

Wind NW,
Charge =
2 Sparks

+111
+151
+140
−153

−191
−190
+195
+165
+185

Battery wire discharged by Wheeler

+174
−180
+176
−182
+170

This reverse charge in Quartz appears normal at the obs [illegible] [illegible] grows slowly & only reaches a maximum deflect about 1 minute, —

Quartz

Apr 7.

Same conditions as last page

$-60^{\#}$	Handle of Commutator in direction which gives + Charge in Glass!!! — 
-58	
-65.	
$+78$	Handle of C, to give ~~as 1st~~ — charge in Glass!
$+74$	" 
$+65$	

Glass — repeated —— Handle same as in last exp with Quartz — 

∓ 180	
-189	
-178	
$+188$	Handle as in 1st Quartz 
$+190$	
$+186$	

Calcite (as

− 40	Handle same as in
− 50	last Exp with Glass
− 43	Other conditions the same
+ 40	Handle same as in 1st
+ 44	Exp with glass
+ 43	

!!!

Dep'd on time, new charge

5 sec contacts = −150   5 12 ...

handle up !!

10 sec " = 0 — —

12 — —

5 sec = — —

This same effect proved to lie in the inducing effect of one of the insulators of the apparatus ——

The instrument was modified so that [illegible] constant earth contact and this source of error ~~eliminated~~ disappeared

Opt - 4 Apr. 8. —

Glass and Calcite give as yesterday opposite deflections

Calcite

5 Sec. Contact
- −142
- −139
- −143

10 Sec. contact
(1) left the scale!
(2) stopped after 220 + passing
[illegible] — a very [illegible].)
(3) left the scale!

2 Sec. Contact,
- −124
- −104
- −79
- −113
- −102

2 Sec Contact
- −68
- −70
- −71
- −74

Apr 9

New arrangement, of Apparatus

1) Glass cas,

5 Seconds Contact = Off scale !!

3 Seconds " , Off scale,

2 Seconds " Off Scale.

1 Second " + 200.

+ Off

+ Off

Quartz

5 Seconds, + 9.5

+ 21.

+ 35.

+ 41

+ [illegible]

+ 40.

+ 52

+ 60

Calcite (k)

5 Seconds, — — 13.0

0,

14.0

+ 0,

" 0.

+ 0, "

10 Seconds — No Effect, —

" " No Effect,

30 Seconds

No Effect, —

Glass repeated —

5 Seconds — Off Scale

30 " "

Quartz (k) -

Calcite (R) in Sparks

effect

Electroscope increased by many
Luminescence — and more charge given
to battery – gave same results —
Frequent discharge of glass
and Calcite showed that all was
in order.

Apr 9

Glass and Sponge

Glass – 5 Seconds. – Off Scale

[illegible] Seconds + [illegible]

+ 183

+ 193

+ 205

+ 187

Sponge – 3 seconds + 3 0

– [illegible]

– 4

+ 4

10 Second,

+ [illegible]

+ [illegible]

+ 20

+ 10

30 sec. + 27

+ 26

+

+87 Opt +4

+91

+85

= +89

Seconds. +79

Glass leans scale at ...

3 +87

[illegible] (b) +45
+40
+42

[illegible] b = 40

[illegible]

5 Seconds. Off Scale —
1 Second. Off Scale —

Glass had been previously washed and held in Bunsen flame to deprive it of all electricity. —

— Apr 12 1880 —

Glass.

30 seconds contact – 5 seconds to earth. — Off Scale ±

20 seconds. — Off Scale —

Electrometer made less sensitive —

3.0 seconds interval = +196
+204
+202 = 199.98
+197
+200

Quartz (a)

± ~~+~~24
+ 37
+ 36 34.20
+ 35
+ 39

Calcite (a)

+ 4.
+ 2.
+ 3.
+ 2.5
+ 2.0

Calcite (b)

+ 4.5
+ 5.0
+ 4.5
+ 4.5
+ 5.0

Quartz b. +40

Glass — 180 —

Glass (b.) (not washed nor heated) clean — never before used. — 185

Apr 13 1880

Quartz (b) 0 pt — 10

30 seconds —

+ 23
+ 40
+ [illegible]
+ 65
+ 64

Glass — (b)

30 seconds. — + 225
+ 225

Glass a
30 sec — Off scale —
−10 = 0 pt
20 seconds. — +199

+123
+126
+118

Quartz. — (a)
20 seconds. — = +16.
+18.
+18.

Calcite (a) −9 = 0 pt
20 seconds −9
Without Charging — −10

Charging −9
−8.
−8. —

−9
−10
−9
−9

Plates in desiccator over night.

Apr. 14

Glass.
10 seconds
+149
+146
+149

Quartz
10 seconds. —
+ ~~100~~ 15.
+ ~~105~~ 15
+17

Calcite
+9
+7.
+7

Glass repeated.
— 8 —
+150
+146
+140
+145

Apr 22

Glass (1) — 30 Seconds contact.

= 166.5
154.5 = 163.2
168.5

Quartz (1)
25.5
18.5 = 22.9
24.5

Calcite (1) No Effect

Quartz (2)
22.5
17.5 = 20.5
21.5

Calcite (2) No Effect

Glass (2)
162.5
175.5 = 169.5
170.5

Glass = 100.0 pret

Quartz (1) = 13.1

Quartz (2) = 12.3

Calcite (1) No Effect —

" (2) No Effect. —

May 1. —
Charge 1 Spark. —

5 Seconds	Glass (1)	137 129. 133	133
	Quarz (1)	13. 13. 13.	
	Calcite. (1)	1. 1. 0.	
10 Seconds	Glass (1)	199 180 189	
	Quarz. (1)	.21 .22 .25	
	Calcite	0 0	

20 Seconds	Glass (1)	225 220 230
	Quartz (1)	34 35 34
	Calcite (1)	+2 +1 0

2 Sparks

20 Seconds	Calcite (1)	2 +~~1~~ 0
	Quartz (1)	+50
	Selen. ½ - (3) Selenite (1) " (2)	135 170 130

Spectacle —	20 Sed	[illegible]	
	10	"	225 —
Lense .	10	"	95 —
	20.		140
Glass plate	10		210
(H) Quarz "	10		20

Quarz lense [illegible] 15-20

Mica plate, Larger = 80 —

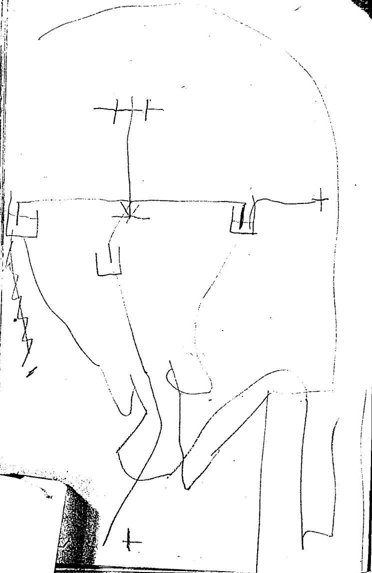
May 12

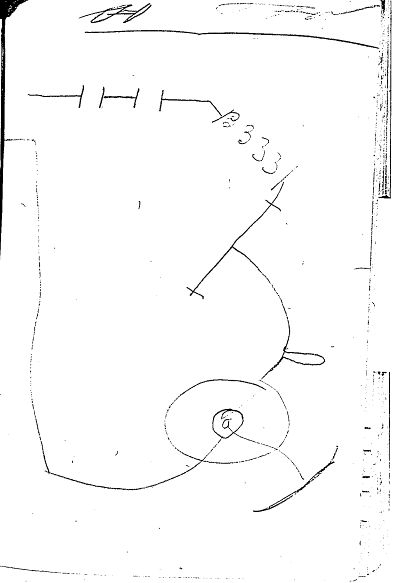
Series — Commercial Solution

4.15, — 22°. — Top Mark 1.6 mm

4.45, — 22°

Time	Temp	Merc.	Diff.	Room
4.15	22°			
4.45	22°	~~[illegible]~~	36.9	24.5
5.25	17°	30.42		23.75

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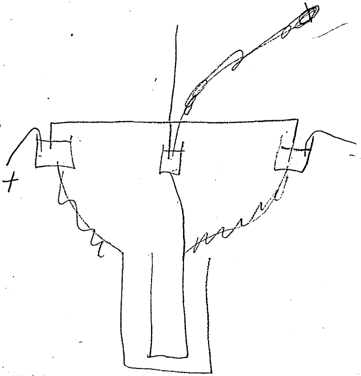
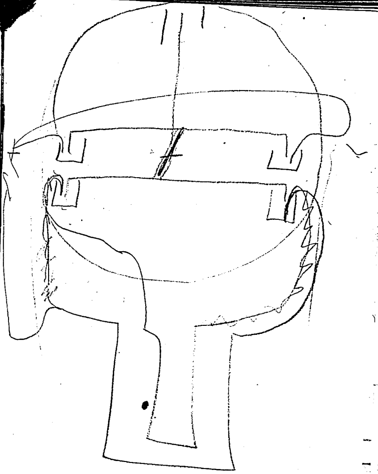
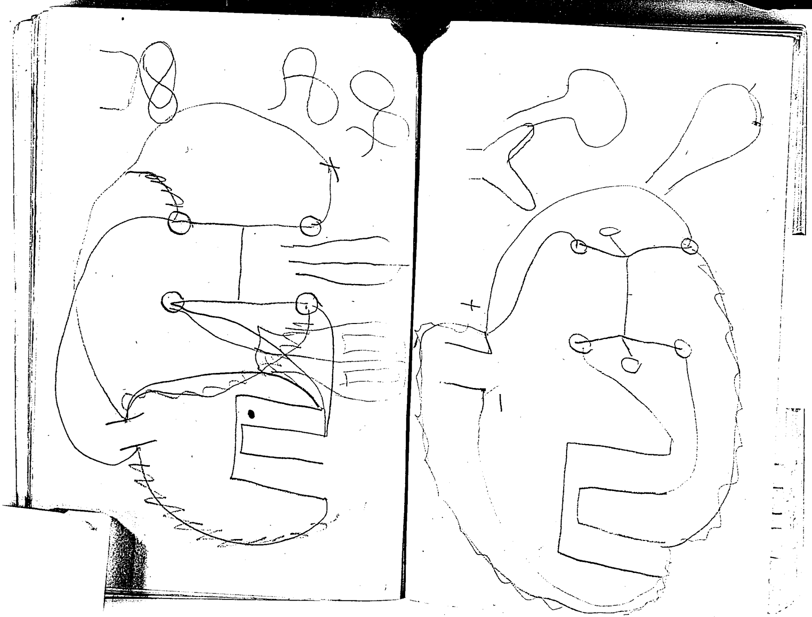
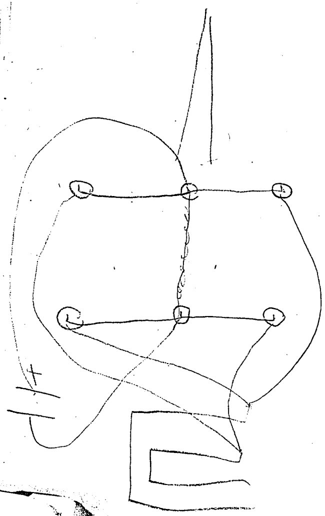
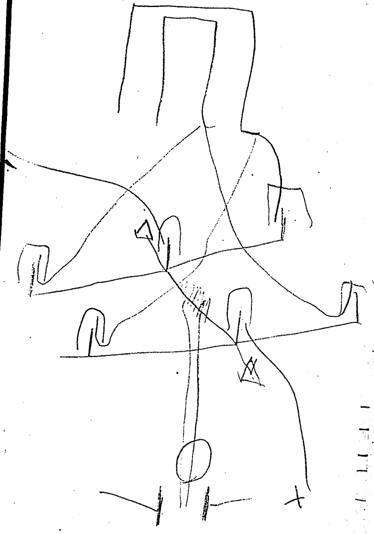
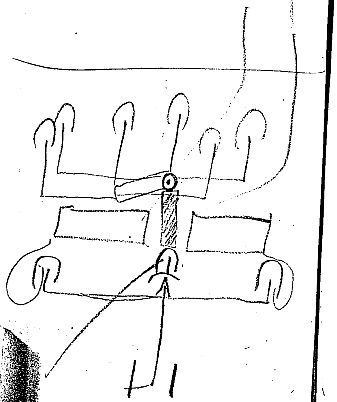


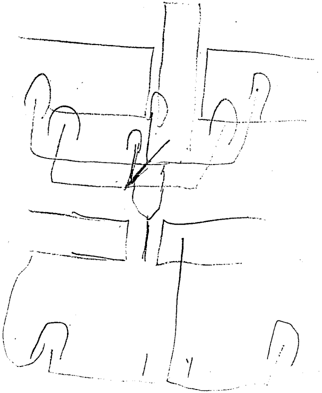


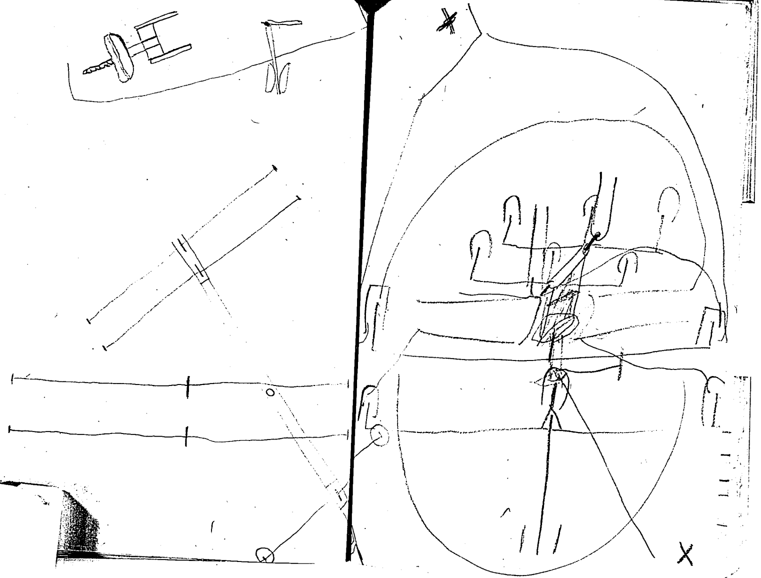


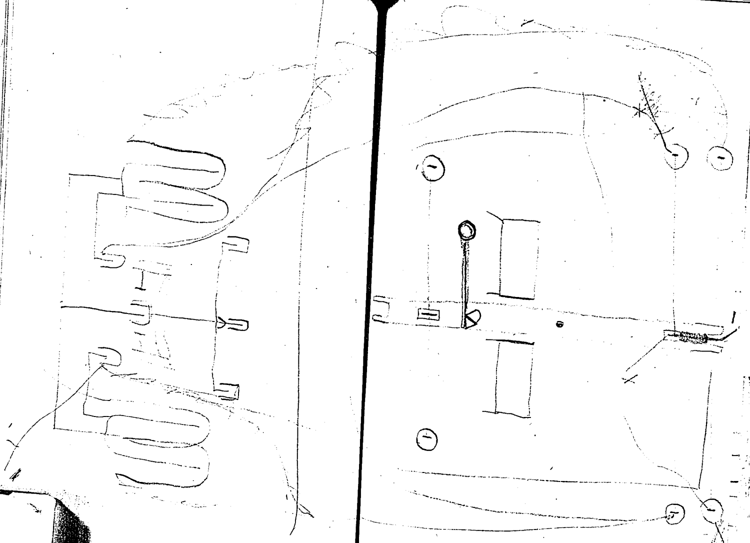


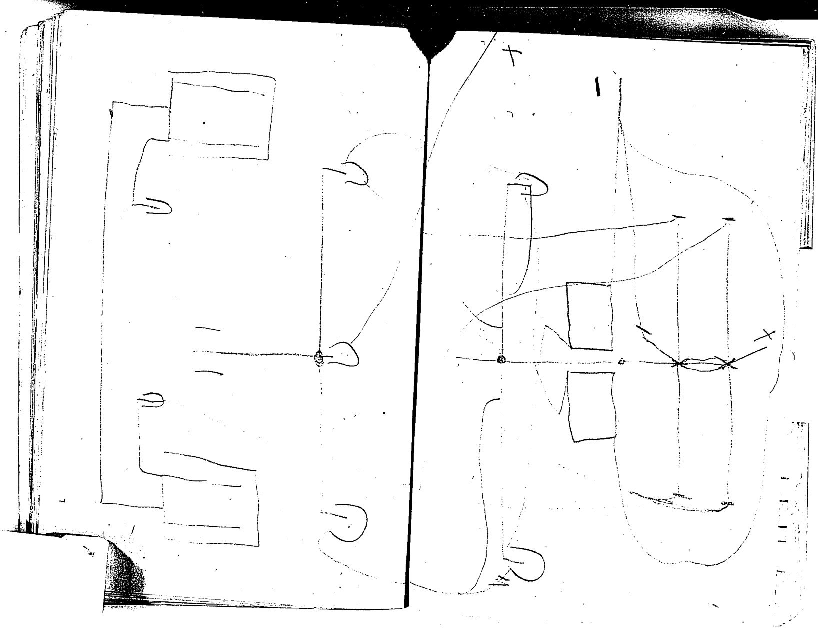


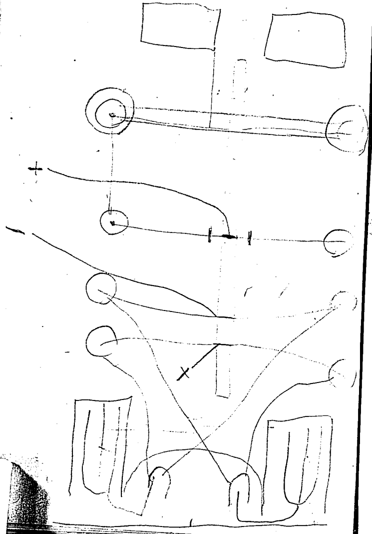


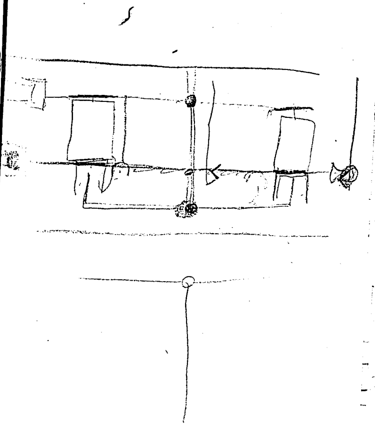


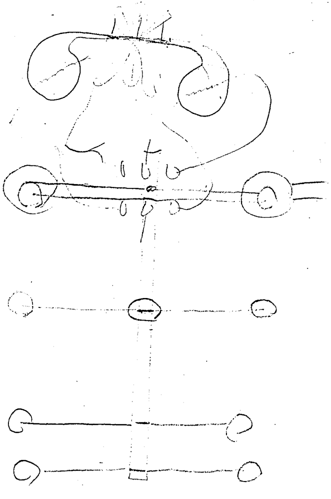


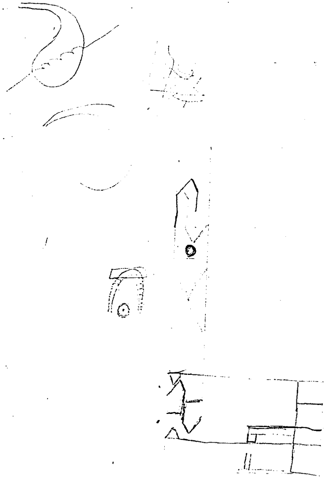












C

C

(1) 23,85 before
23.25
.60

(2) 23,90 after
23.35
.55

(3) 23,95
23 20
.75

(1) 4,28
5 6 0
1.32

4

#

	log sin.	sin defl
Sin Defl. 7° 0'	= 9.0855945	0.12187
6° 7'	= 9.0263865	0.10662
6° 3'	= 9.0240157	0.10569
6° 0	= 9.0192346	0.10453
6° 0	= 9.0192346	0.10453
5° 36' 30"	= 8.9913020	.098016

Times are. 15 min. + 20, 45 + 19.0

+ 24 + 25

(1) 0.25 hours

(2) 21.0

(3) 40 0

(4) 64.0

(5) 89.0
90.0

Set of iron in Mag. field

Magnet No 1 3 in. 1/2 in. -oc

Magnetized Dec 20, @ 6.15

Tested on Rowland's Sin Gal.

			Defl #
Dec 20	630 PM.		7° 0'
" 21	3 15 "		6° 7'
" 22	11.15 AM		6° 3'
" 23	11 15 "		6° 0'
" 24	12 15 "		6° 0'
" 24	3 15 "		5° 39'
			5° 39
" "	"		5° 34 = 5° 36' 30"
			5° 34

Two readings with magnet ... probably (... different)

Temp about 12° C

Amt Iron Filings less than ... grs.

Dec 25 — Infl of hot water

Magnet II. Same size Magnetized at same time & another same way as I. gives on being placed on sin Gal (Ben Ann)

11. 35 AM. $6^\circ\ 6'$
$6^\circ\ 6'$

Exposed for 10 min to boiling ~~water~~. —

$\log m = 8.8507572 \quad m = .07091$

Dec 25 — Xmas

10 30 AM. $5^\circ\ 39'$
$5^\circ\ 39'$

Magnet inserted in same test tube with Hg & water — & placed for several minutes in a beaker of boiling water to test heating effect. — Hg, — slightly warm to touch after taking out. Magnet replaced afterwards gave

11. 15 AM. — $5^\circ\ 39'$
$5^\circ\ 40'$

Exposed to boiling water for a few seconds gave —

$\log m = 8.9431743$

$m = .087735$ (1)

$5^\circ\ 2'$
$5^\circ\ 2'$

Boiled for 10 min gave (2) $4^\circ\ 5'$
$4^\circ\ 5'$

Opt. 179° 54'

Dec 25, <u>Opt. reset</u> —

Magnets (2) set in position

lin 5 1080

lin 9.0233 7212

Reads, at [illegible].30 PM.

—	—	6° 12'
		6° 12'
Dec 25	1. PM.	6° 13'
		6° 14'
Dec 26.	10.30	6° 11'
		6° 12'
"	3.30	6° 8'
		6° 9'
	4.30	6° 9'
		6° 9' } 6° 9'

1

4.30 to Six. —
Infl action No change

Dec 27 12 M. 6° 5'

28 1 P.M. 6° 0'

Dec 28 1 P.M. 6° 0°

6° 0

" 29 12 P.M. 5° 57' 30

Ridg. - 29 1.30 5° 58'

After digesting with HCl.

4 P.M. 6° 3'

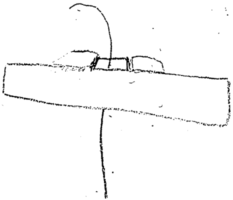
After Aqua Regia 6°

Dec 31 11.45 A.M. 5° 58'

5° 55'

~~Jan~~ 7 1 PM 6° 4'

6° 4'



Action of Magnet on Light.

The light introduced into field + to lines of magnetic induction

For Faradays Glass Coef = 1.

CS_2 = .74

$ZnCl_2$ = .77

Flint Glass = .53

See Verdet & C. Neumann

Infl of Temp on Magnet I

Jan 8. —

4 P.M.

Defl	Temp
2° 49'	36°.9
2° 49'	34°.4
2° 49'	47°.7
2° 40'	63°.8
2° 24'	83°.0
2 28	— on Cooling
2° 45	(Shifted)
2° 40	98°

Supersaturation of Vapor

H_2O over paraffine —

Heated to about 100° —

[illegible] in [illegible] of bath

around cork —

[illegible] slowly — [illegible]

[illegible] without any disturbance

Jan 27 Supersaturation of

CS_2 vapor over H_2O.

dist. water — boiled out —

cooled to 40°. CS_2 introduced

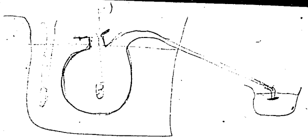
in bent tube water raised to

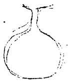
56° CS_2 then suddenly vaporized

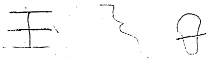
filling the tube. — allowed
to cool, — contracted slowly
to 43.5° then noticeably faster
at 43.0 vapor half gone. —
condensing on sides of tube
forming drops which cling to
glass & in two instances allow
H_2O level to rise over them a
42° vapor nearly gone. —
Bar 75.95 mm

Boiling Pt CS_2 (Watts) 46.6°
Prime — a 47.9° = 1.8
(Barker) 46.0

Contents of tables give from 45°
47.9°







.38
8

99235
76
99159

99159) 287.693 (289.032
198318
892750
793272
984780
892431

892750
892431
319000
297477
215230

— NH_3 —

May 20. — Capacity & Coef of Expansion of Receiver. —

Temp 40.2

Wt [illegible]lle = 380.742
93.051

Contents @ 40.2 = 287.693 gms

Density H_2O @ 41° = 0.99197
Density H_2O @ 40° = 0.99235

Diff. .00038
p.p @ .1° = .000038
2

.000076

Density @ 40°.2 = .99235 6
= 0.99228

x^{cc} @ .99228 = 287.693 gms

Contents @ 40°.2 = 289.933 cc

99228) 287.693 (289.933 cc
198456
892370
793804
985660
893052
926080
893052
330280
297684
32596

Temp 33.6°
Wt Full = 381.354
93.051
288.303 gms.

Density @ 33.° = 99485   40.2
" 34° = 99452   33.6
Diff .00033   6.6

pp. = .000033
6
.000198   .00019
~~99485~~   99452
Density @ 33.6° ~~99467~~ .99471

99471.)288.303(289.835 cc
198942
893610
795768
978420
895239
831810
795768
360420
298413
620070

Contents @ 33.6

289.835)289.933(1.00033
289.835
0000980000
869505
1105950
869505
2364450
2128845

6.6)0.000337(.00005
33/0

Vols of NH_3 + Aq. —

−15	.996107
−10	.997279
−5	.998602
−0	1.
5	1.001472
10	1.003170
15	1.005059
20	1.007140
25	1.009373
30	1.011734
35	1.014247
40	1.016962
45	1.019531

Sp Gr = .9463 @ 12.5°C

Muncke — Ausdehnung Tropfbarer Flussigkeiten

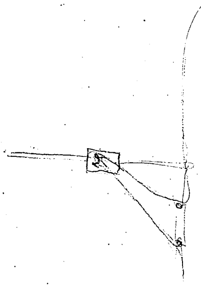
~~Mem~~ Acad. St Pet. (Memoirs presentés par divers Savants) (p. 352) 1831

Gave bubbles @ 45°C

Menlo Park Notebook #108 [N-80-07-02]

This notebook covers the period July 1880. All of the entries are by Edison with the exception of one entry by Francis Upton. Included is a list of possible electrical inventions, two of which -- an electric balloon and an electric railroad to pull canal boats -- are also drawn by Edison in the book. There are also notes on vacuum experiments with lamps, notes on gold deposits in sand, drawings of an ore separator, and calculations by Upton of the amount of copper needed for a central station system. The label on the front cover is marked "T A Edison." The book contains 284 numbered pages.

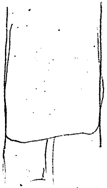
Blank pages not filmed: 12-25, 32-37, 40-53, 56-83, 86-101, 104-117, 126-127, 132-139, 148-187, 190-195, 198-243, 252-277.



allowing it to burn

Canal System 1
RR Train System 2
Rockdrill also Rock Tamper 3
Balloon - 4
Transfer power 5
High Speed Telgh RR - 6
System Signals for Electric RR 7
24 inch guage on canal with E Loco-to drive 8
Canal boats, 8
Elevators 9 -
Submarine, Engine, 10
✓ System submarine, lighting 11
Submarine Electric Railway, 12
Steamship feeler for Ships Icebergs, 13
Lighting submarine buoys - 14
Emerywheel with 5000 Rev motor 15
Motor applied Lathes Etc splice belts, 16

Over



Our system Lighting have Electric fire Engine to attach our mains 17
devise Electric fire Engine,

Ice sawing dynamo Engine. 18

Portable Electric drill. 19

Electric Band & Circular Saw
Can run armature with battery 20

Electric Well Borers. 21

Torpedos

Band saws

Circular saws

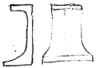
200000
100000
25000
35000

Qu. Whether
8 candle light
100 Ohms hot
giving 16 per H.P.
10 lbs. of Cu

Or 8 of 16 candles
100 Ohms hot
20 lbs. Cu. per lamp

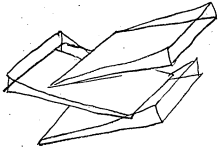
20 lbs. of Cu. per each lamp

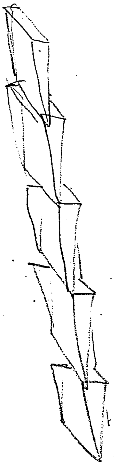
47 cts

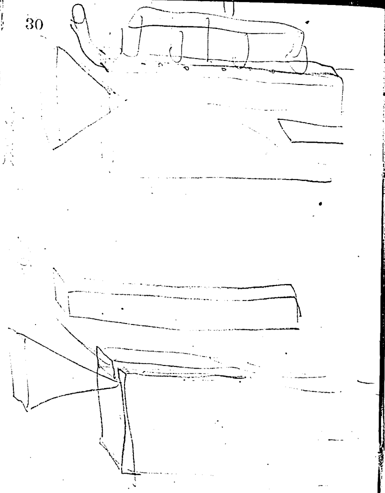


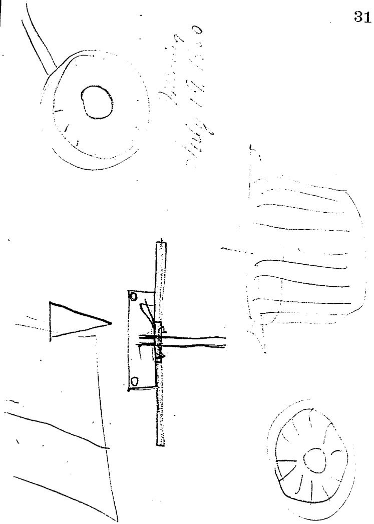
July 19. 1880

Mining.









5000000

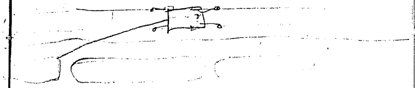
5°

5⁰⁰⁰

$500

$5000000

Aug 6 80



150. 5°

150. 10

1 75.

Fordwainer

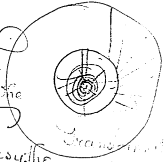
Jo

Fordwainer

Protochloride

Protochloride

Forsyth



Forsythe

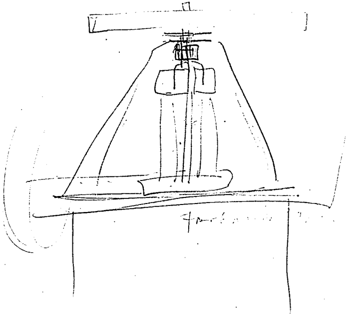
Forsythe

Transformation

July 9 1880

TAE

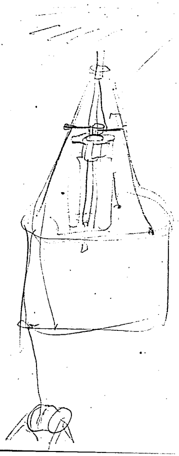
Electric Balloon Experiment



July 7 80

12

15



2

2,000.
1000
2,000,000

8400
47,000
12

29

42000
29
378000
84000
1,218000

13- 1300.

32
4
128
6
768.

1300
16
7800
1300
20,800

27

108.

36.) 1300

~~1300~~ / 3600
27

1300
27
9100
2600
35100

32
8
256
16
1536
256
4096

36,000
5
180,000

1300) 180 000 (138
1300
5000
3900
11000
10400

1300
138
10400
3900
8000. 1300
179,400

138. C per lb Coal.

36. 3½ - lb Coal. 128. 36.

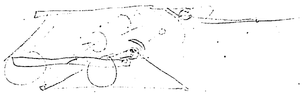
40
3
120

3½) 128 (

72

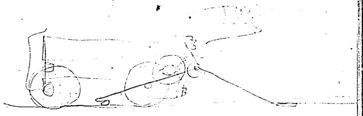
108.

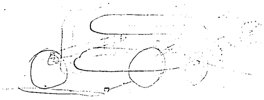
July 8, 88



July 21 1880

[illegible]





renc

Fortune

60

60,000
60
3,600,000

Fortune

3

Fortune

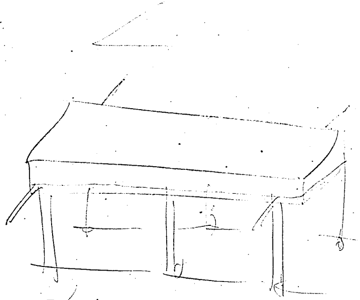
2 Fortune

Fortune

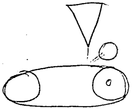
Fortune

Fortunate

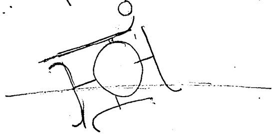
Fortune

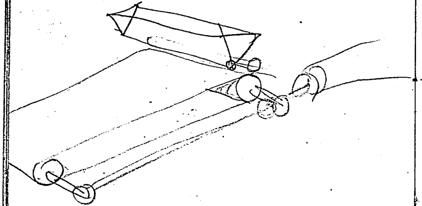


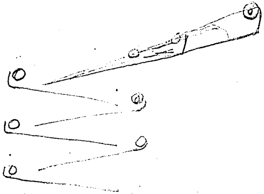
July 7. 80

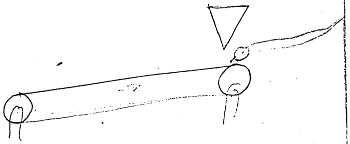


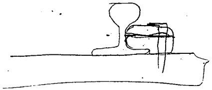
73.. 25

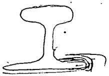


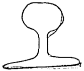


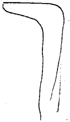


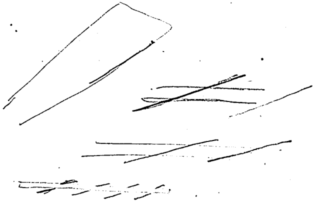


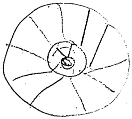




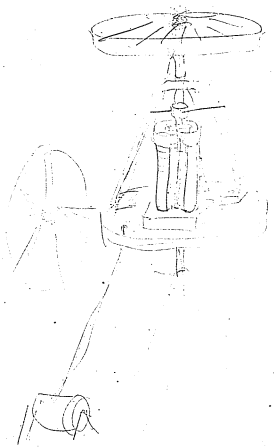








July 7. 80

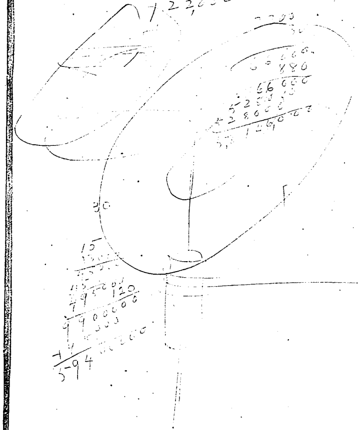


July 7. 80

For 14-

July 7. 80'

2200
3 60
22,000



15
120
594

400

4

80

15

4

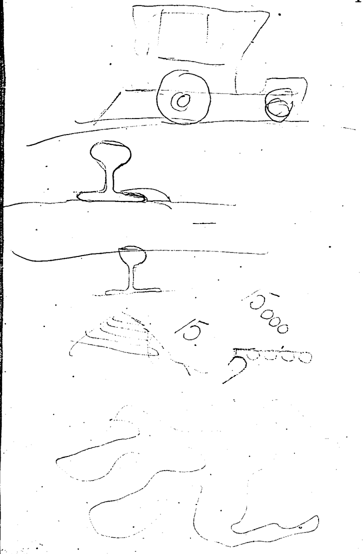
250 $\frac{30}{300}$

125

250

15
20
300

80



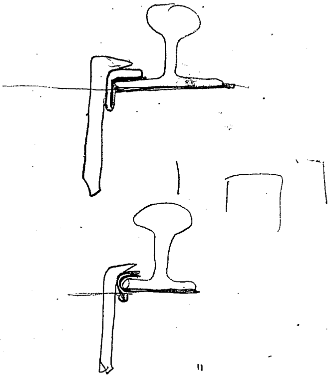
8

64
44
256
256
2816

14001

7

300 / 3300 (
110
300
33.500



$\frac{3}{3}$

$\underline{1}$

$\frac{3}{30}$ $\frac{1}{10}$

$\frac{1}{10}$ $\frac{14}{1}$ $\frac{14}{10}$

$10\overline{)14}$

$$\begin{array}{r} 1.4 \\ 60 \\ \hline 9.4\,0 \end{array} \qquad \begin{array}{r} 1.8 \\ 60 \\ \hline 10.8\,0 \end{array}$$

5

$$\begin{array}{r} 1.8\text{m} \\ 60 \\ \hline 10.8.0 \end{array}$$

4

$\frac{6}{6}$ $\frac{3}{1}$ $\frac{13}{20}$

$\frac{1}{10}$ $\frac{5}{9+8}$

$\frac{12}{20}$ 10

$\frac{13}{20}$ 8 11 $\frac{8}{9+8}$

$\frac{2}{2}$

$\frac{\frac{13}{20}}{\frac{1}{10}+\frac{13}{20}}$ $\frac{13}{2+13}$

$\frac{13}{15}$ 8 $\frac{2}{15}$ gal

$\frac{\frac{1}{10}}{\frac{1}{10}+\frac{13}{20}}$ $\frac{2}{2}$ 13 lie nuts

$\frac{13}{15}$ $\frac{3}{4}$ $\frac{39}{60}$ $\frac{6}{60}$

$\frac{45}{60}$ $\frac{2}{4}$ $\frac{13}{20}$ $\frac{2}{20}$

$\frac{6}{60} \times \frac{.329}{1000}$

329

1974

60000

60000) 329 19740 (.03

$\frac{3}{4}$ $\frac{.329}{.1}$ 329 1987

$\frac{1}{4}$ 19.7 3.7 329

4.9

14.7 2

.329 $\frac{6}{60}$ $\frac{.14}{1}$

$\frac{6}{60}$ $\frac{1}{14}$

60000) 19740 .032

174000 60 840

1920 .03 $\frac{140}{840}$

.18 .032 .180

60 60

10080 1920 10080 4

4

$\frac{180}{10.80}$ .180 .180

1.08600 10.800

4 4

$\frac{3}{4}$ [illegible] $\frac{1}{20}$ [illegible]

$\frac{3}{80}$ [illegible]

[illegible]

10 lights

$\frac{1}{10}$ of ohms

$\frac{50}{10}$

$\frac{51}{10}$

$\frac{50}{10}$ $\frac{51}{10}$ $\frac{3}{4}$ $40)\overline{153}$ 120 33

$3\frac{33}{40}$

$\frac{50}{10}$ $40)\overline{150}$ 120 30 $3\frac{3}{4}$

$3\frac{3}{4}$

$\frac{5000}{5014}$

$\frac{1}{10}$ $\frac{3}{4}$ $\frac{3}{40})\overline{300}$ 280 $(.07$

$\frac{1500}{2004}$

$3\frac{3}{4}$

$\frac{15}{4}$

1.5

$\frac{3}{204}$ W $\frac{1500}{2004}$ W

$\frac{3}{4}$ V

$\frac{50}{10}$ $\frac{50}{10}$ $.50$

$\frac{50}{10}$ $\frac{10}{51}$ $51)\overline{500}$

$\frac{5}{.51} \times \frac{3}{4}$ $\frac{15}{.204} =$

.73

$\frac{.1}{.51}$ $\frac{3}{4}$ $\frac{.3}{.204}$ $\frac{3}{204}$ V

$.204)\overline{15000}$ 1428 720 612 $(73$

$\frac{1}{10} \div \frac{51}{10}$ $\frac{1}{51}$ $\frac{3}{204}$

$\frac{1}{10} \div \frac{10}{51}$ $\frac{10}{510}$ $\frac{5}{1}$ $\frac{51}{10}$

$\frac{50}{10}$ $\frac{50}{10}$ $\frac{10}{50}$ 500

4

|

$\frac{2}{1}$

$\frac{2}{1} \div \frac{1001}{10000}$

$\frac{20000}{10000} \div \frac{1001}{10000}$ 20000

$\frac{20000}{10000} \div \frac{10000}{1001}$

$\frac{20000}{1001}$

$\frac{100\,00000}{1001\,0000}$ ~~2000~~

$1001 \overline{)\,20000}$

20 U 380 $\frac{19}{20}$ / 380

$\frac{10000}{10000}$

$\frac{2}{10000} \div \frac{1001}{100000}$ $\div$

$\frac{2}{}$

$\frac{20000}{10010000}$

$\frac{10000}{1001}$

$\frac{10000}{10010000}$

$\frac{2}{1001}$ e

$1001 \overline{)\,.329}$

$\frac{2}{1} \div \frac{1}{10}$ $\frac{20}{10}$ $\frac{10}{10}$

$\frac{2}{1}$

$\frac{2}{5}$ 4

$C \frac{E}{R}$

ohm

1000 1000^{5} = 4400

$\frac{10}{0} = \infty$

2.5

$\frac{1}{1000000}$ 1 interval

$\frac{1}{10}$

2

$\frac{1}{10000} + \frac{1000}{10000}$ $\frac{1}{1000000} + \frac{1}{10}$

$\cancel{10}/\cancel{1000000}$

100

$\frac{1001}{10000}$

$C \frac{E}{R}$

$CR = E$

$R = \frac{E}{C}$

$\frac{E}{R}$ $\frac{10}{2} = 20$ $\frac{10}{1}$ 100

100 $\frac{10}{0} = \infty$

330000

7460~~000000000~~

7.460
60
465760 0

3
2
3
4

33000) 7460000000000 (244242
66
146
132
140
132
80
66
140
132
80
66
140
132
80
66
140
132
80
140

.414

33) 7460000 (226060
66
186
66
200
198
20

226060
463

678180
904240
904240
100000000

2442424242424
443

7327272727272
9769696969696
97696969696

1081993939383812

1.3562325) 100000000

.76
10 | 746
7406
22316

13.825
981
13825
110600
124425
1.3562325
443
6008109975

Menlo Park Notebook #110 [N-80-08-00]

This notebook has no dated entries but was probably used in 1880. All of the entries are by Francis Upton, with the exception of one entry by Edison, and relate to calculations for a central station system. Most of the entries are block-by-block calculations of the copper needed for the Pearl Street district. There are also a series of notes and calculations relating to the economy of the central distribution system and to the cost of a system of 10,000 lamps as compared to the cost of gas. The label on the front cover is marked "Hammer" and "N.Y. Cen. Station." The book contains 284 numbered pages.

Blank pages not filmed: 1, 138-284.

1013 fut

127
27.
887

Rich 1

if 1013 feet

127
33
381
381
4191

Block 2

Lamps
1207 ft — 280
50
10 | 330
33

1831
33
5493
5491
60399

Block 3

31
762

260
40
10 | 300 lengths
30

36.1
30
1083.0 ft

Block 4

81 -
762 —

Lamps
10 | 340.
34

36.1
34.
1444
1083
1227.4 lbs

Blach 5

21-
$\frac{4}{62}$ -

140
25
10)165 Lamps
16.5

72.2
16.5
3610
4332
722
1191.30 lbs

21-
$\frac{4}{72}$ -

170
75
10)245 lamps
24.5

27.6
24.5
138 0
1104
552
676.20 lbs

Block 6

$$\frac{9}{4\,7\,0}$$

Lamps

$$\begin{array}{r} 120 \\ 50 \\ \hline 10\,|\,170 \\ \hline 17 \end{array}$$

$$\begin{array}{r} 27.6 \\ 17 \\ \hline 193\;2 \\ 276 \\ \hline 469.2 \end{array}$$ lbs

$$\begin{array}{r} 5 \\ 831 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ 50 \\ \hline 10\,|\,80 \\ \hline 8 \end{array}$$ Lamps

$$\begin{array}{r} 83.1 \\ 8 \\ \hline 66\,8.8 \end{array}$$ lbs.

Block 7.

Ft. — Lamps
47½ — 40
60
16 | 600 Lamps
16

27.6
10
276.0 lbs

---

8 ft.
831 — Lamps
10 | 60
6

86.1
6
516.6 lbs

Block 8.

ft Lamps

831 — 10/2220
22

86.1
22
1722
1722
1894.2 lbs

Block 9

Fl.	Lamps	86.1
		7.5
831 —	10/735.	4305
	7.5	6027
		645.75 lbs

Fl.	Lamps
1665 —	10/310
	31

$$\begin{array}{r} \cancel{140.4} \\ 31 \\ \hline 1404 \\ 422 \\ \hline 4352.4 \text{ lbs} \end{array}$$

$$\begin{array}{r} 186 \\ 31 \\ \hline 186 \\ 558 \\ \hline 5766 \end{array}$$

Bank 10.

71 Lamps

1065 — 10/230
23

140.4
.23
4212
2808
3229.2 Ans

186
23
558
372
4278

1013

127
125
635
254
127
15775

Block 11

1st Lamps

120 — 10 | 125 — 12.5

2d Lamps

752 — 140
105
10 | 245
24.5

183
12.5
915
2196
2287.5 lbs

70.3
24.5
3515
2812
1406
1722.35 lbs

127
.11
127
127
1397

Block 12

ft. Lamps

1207 — 10 | 110 = 11, 40 × 70

752 ft.

183.9 × 11 = 2023.0 lbs

40
70
10 | 110
11

70.3 × 11 = 773.3 lbs

9 ft. Lamps

479 — 10 | 140
14

28.8
14
1152
288
403.2 lbs

Fr	Lamps	
1207	— 10/20 2	183 2 366. lbs
762	— 10/20 — 2	72.2 2 144.4
479	— 10/280 28	28.2 28 2204 576 796.4

Block 14

Fr		Lamps	72.2
			1
762	—	10/10	72.2 lbs
		1	
396	—	10/40	20.0
		4	4
			80. lbs

Block 15

71 –
762 –

Lamps
10 | 240
4

72.2
4
288.8

396 –

10.0
40
10 | 140
14

20.0
14
280.0 lbs

167 –

50
100
10 | 150
15

3.612
15
18060
3612
54180

71- Lamps

167- 40
10
30 3.612
80
15 | 80 288.960 lbs
80

472- 10 | 30
3 27.6
3
82.8 lbs

Block 17.

31	Lamps	6.050
220 —	10/90	9
	9	54450 lbs
472 —	10/80	27.6
	8	8
		220.8 lbs
831 —	10/110	86.1
	11	11
		946.1 lbs

Block 18

Ft	Lamps
831	10/80
	8

861
6
688.8

186
6.5
930
1116
1209.0

Birch 19.

Ft. Lamps.

1065 — 10/65
6.5

1046 — 10/75
7.5

140.4
6.5
7020
8424
912.60 lbs

137.8
7.5
6890
9646
1033.50 lbs

187
11
187
187
2057

Rivet Co.

Lamps.

$\mathcal{J}_1$ -

1065 — 1 / 110.
11

~~143.2~~
~~11~~
~~1575.2~~
~~lbs~~

$\mathcal{J}_1$ -

1046 — 10 / 110
11

137.8
11
1378
1378
1515.8
lbs

Block 21.

Ft — Lumps.

396 — 10/55 — 5.5 — 20.0 × 5.5 = 110.00 lbs

479 — 10/50 — 5 — 28.8 × 5 = 144.0 lbs

167 — 10/65 — 6.5 — 3.612 × 6.5 = 18060 + 21672 = 23.4780 lbs

167 — 10/75 — 7.5

3.612
7.5
18060
25284
27.0900 lbs

Block 22.

7- Lamps

167 — 10.) 130
15

3.612
15
18060
3612
54.180 lbs

Block 23.

Ft		Lamps	
220	—	90	6.05
		60	15
		10 | 150	3025
		15	605
			90.75
			.66
364	—	10 | 70	
		7	

16.2
7
113.4 lbs

Block 24.

Ft.	Lamps	
1046 —	10/90, 9	137.8 × 9 = 1240.2 lbs
634 —	10/70 7	49.6 × 7 = 347.2 lbs
364 —	10/150 15	16.2 × 15: 81.5, 162, 243.5 lbs

Block 25.

71-
1046 —
634 —

Lamps.
10/145.
14.5
2.25.
80
10/305
3.05

135.2
14.5
6760
5408
1352
196.040 lbs

49.6
30.5
2480
1488
1512.80 lbs

Block 26

71	Lamps		6.05 × 10.5 = 3025, 605 = 63.5 25 lbs
220	—	10 / 135 = 10.5	
537	—	10 / 110 = 11	18.25 × 11 = 1825, 1825 = 200.75 lbs
364	—	45 + 20 = 65; 10 / 65 = 6.5	16.2 × 6.5 = 810, 972 = 105.30 lbs

Block 27.

71 — Lamps

$$16.2 \times 8 = 129.6 \text{ lbs}$$

364. —

$$30 \times 30 = 620$$

$$10 \overline{) 88}$$

634. —

$$10 \overline{) 80} = 8$$

$$49.6 \times 8 = 396.8 \text{ lbs}$$

337. —

$$10 \overline{) 50} = 5$$

$$18.25 \times 5 = 91.25 \text{ lbs}$$

Birch 28.

J1- Lamps 49.6
634- 10/260 2.6
26 29.76
9.92
728.96
lbs

Block 29.

71 - Lamps.

752 - 10/155.

15,5

70,3
15.5

35 7 5
3 5 7 5
7 0 3

10 8 9,6 5 lbs

Block 30.

Jr-	Lamps.	70.3
752	10/80	8
	8	56.24 lbs
1280	10/20	204.8
	2	2
		409.6 lbs
479	10/210	28.8
	21	21
		288
		576
		604.8 lbs

Bldg 31.

Ft.	Lamps	
479 —	10/200	28.8
	20	20
		576.0

Block 32

167^{51}_{2} — Lamps
10/105
16

1.806
.16
10836
1806
2.8896 lbs

Block 33

Ft — Lumps — 6,050

$$\begin{array}{r} 6{,}050 \\ \times\ 11 \\ \hline 66{,}550 \\ \text{lbs} \end{array}$$

220 — 105

$$\begin{array}{r} 105 \\ 5 \\ \hline 10)110 \\ \hline 11 \end{array}$$

637 — 45

$$\begin{array}{r} 45 \\ 25 \\ \hline 10)70 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 51.2 \\ 7 \\ \hline 358.4 \text{ lbs} \end{array}$$

Block 34.

Ft.	Lamp.	
		9.11
537 —	10/90. 9	× 9
		81.99 lbs
1057 —	10/50 5	137.8
		× 5
		689.0 lbs

Block 85

ft — Lamps

1051 — 10 | 240.
24

137.8
24
5512
2756
3307.2 lbs

Block. 36

Ft. Lamps

1280. = 10|180 / 18

```
  204.8
     18
  16384
  2048
  3686.4 lbs
```

Birch 37.

71 —
753 — 10|20
2

Laurs

70.3
2
140.6
lbs

1282 10|70
7

204.8
7
1433.6 lbs

Blk 38

71

753.

Lamps

10/120

12

70.3

12

84.36

1280.

10/

4

204.8

4.

19.2 lbs.

Block 39

Ft-	Lamps	70.3
		6
753	10/60	421.8
	6	lbs
1280	10/10	204.8
	1	1
		204.8 lbs

Block 40

Nr — Länge

436 — 10 / 90

9

51,2

9

460,8 lb

Block 41

Ft — Lamps

636 — 10/.150

15

51.2
15
256.0
512
768.0 lbs

Block 42.

ft — Troughs 1326

1051 — 10/52 6630

5 ½

130 — 4/80

6

1326

6

7956 lbs

Block 43

71 [illegible] 137.8 / 9

1051 — 91.5 / 9 — 240.2

11.30 — $11/90$ / 9

159.5 / 9 / 135.5 lbs

Pilach 44

80 — 10/22

2

409

40.96

583,6

Block 45

Lamps

71

1280 — 10/70

7

204.8

7

1433,66

Block 46.

ft — Lieupo. 204.8

1280 — 10/30 3

3 614.4

753 — 10/45 70.3

4.5 45

3375

2812

1280 — 10/45 316.35

4.5

204.8
45
10240
8192
9216.0 lbs

Block 47.

753 — 10/110
11

70.3
11
77 3.3 lb.

Block 48.

Ft — Lengths

636 — $10\overline{)210}$ 21

$$\begin{array}{r} 51.2 \\ 21 \\ \hline 51.2 \\ 1024 \\ \hline 1075.2 \end{array}$$ lbs

Block 49

"

Lampos

$\frac{3}{4}$

636

10/200

20

5,12

20

10240 lbs

Block. 50.

71 Lamps.

1130 — 10/150
15

159.5
15
7975
1595
23925 lbs

Block 51.

71 Lamps
1130 11/140
14

1595
14
6380
1595
22330 lbs.

4352
3229
912
1575
10668

5766
4278
1209
2057
13310
10668
2642

Lbs

4941.
6039.
1083.
1227.4
1191.30
673.20
409.2
688.5
276.
516.6
1877.2
645.75
5766 ~~4033.11~~
4278 ~~2227.2~~
2287.5
1722.35
2013.
773.3
403.2
3[illegible].
114.4
[illegible].4

35700

Lbs
Continuation

722.2
801.
288.8
243.
54.180
288.96
82.8
54.45
220.8
946.1
688.8
~~[illegible]~~ 1209.
1033.50
~~1575.2~~ 2057
1515.8
110.0
144.3
23.4780
27.09
54.180
90.75
113.4

8648.
35700
348

Over

lbs continued.

1240.2
347.2
243.5
1960.40
1512.80
63.525
200.75
105.30
129.6
396.8
91.25
128.96
1089.65
56.24
409.6
604.8
576.0
28.896
66.550
358.4
81.99
689.
3307.2
3686.4

17363.

OPE

ok

24630.
17363.
8648.
35700

8 6 3 41. Total

lbs. corrected

86341.
2642.
~~8~~8983

1103.

Weight - Continued.

140.6
1433.6
843.6
819.2
421.8
204.8
460.8
768.
689.
792.
1240.2
1435.5
4505.6
1433.6
614.4
316.35
921.6
773.3
1075.2
1024.
2392.5
2233.

28.530

24630. corrected

144
84
60.

57.

84 -

16
9
144

50.

40
200
8000

84.

3

35.

84
15
420
84
1260

4

12.

84
12
168
84
1008

3200.

50c 9 per horsepower

9 16.

600 hours
7 per hp. 12 candles each.

300, 9 per hp 16 candles "

Lamps 35c

84
600
50,400
60
302 4000

~~20 cents~~

14.45 –

~~Forbes~~

Drexel Morgan

Morgan

$30 24/100

Morgan

16
8
128
600
76,800
60
4 60 8 000

16
[illegible]

1760.

Morgan

Morgan Mr

30 24
14 45
$15.79

46.00
17 60
28,4

309 [illegible]

16
7
112
600
67200 60
403 2000

14 45

1200

4000

4000
160
2310

14.45

168
16
168

At present lamps are
made which will give
16 candles for 1/8 of
a horse power of energy
in the shape of currents
of electricity.

That is 8 lamps may
be obtained ~~from~~ each
giving 16 candles for one
horse power or 33000
ft. lbs. per minute of
available electrical energy.

That is 8 lamps each
giving 16 candles if im-
mersed in a calorimeter
will show 33.000

ft. lbs per minute given
to the water in heat.
The life of these lamps
will average 600 hours.
giving 16 candles, that is
if 10000 lamps are lighted
and a record kept of
the hours that they gave
light, the sum total of
the lighting time of all the lamps would
be 6000000 hours

At 8 per horse power of 16 candles the light is estimated as costing the company ¼ ct per hour that is for 600 hours $1.50

~~$1.50~~

	$1.50
Cost lamps	.35
	$1.85

For 10,000 lamps

For power	$15.000
For lamps	3.500
	18,500

Received from these at $1.50 per M

	$45.000
	18.500
Profit	$26 500

$8 \overline{)128}$ candles in eight places
16.

for a H.P. of current.

$12 \overline{)128}$
10.7

~~10 per H.P. 12 candles each~~

10 per H.P 12 candles each

$1/4 \times 8 = 2$ cts per hour

2 cts per hour
600 hours

$12.00 for 10 lamps horse power
3.50 for 10 lamps cost.
$15.50

$1.55 per lamp cost
to company

At 9 per horse power
there can be obtained
from the same plant
1/8 more lights

$8 \overline{)10000}$
1250
11,250 lights
.35 lamps
56250
33750
393750

15000
393750
$189375[illegible]

Receipts 145000
7375
52355

$52355
189375
$3[illegible]
26500
6917.5

Increase profits $ 6917.5

11 lamps for 1 Horse power

11 lamps for ~~$~~ $.02 cts

600

$12.00

3.85

11) $15.85

$1.44

35
35
3[illegible]

1.55
1.44

11 cts gain per lamp

1/2 5.5 cts (to be added [illegible]

1/5 2.2 cts

Company sells 10 lamps

Tests show that 10 lamps of 12 candles each may be obtained from each ~~horse~~ horse power of electricity. That is if such a lamp were, when giving 12 candles, immersed in a vessel of water, the water would rise in temperature at a rate indicating that 3300 ft. lbs of energy were added to it every minute in heat.

Such a lamp will last on a average 600 hours

That is, if 10000 lamps were lighted at irregular or regular intervals and a careful record were kept of the time that each lamp was giving 12 candles of light, and after every lamp had ceased to give light these various burning times were summed up, it would be found that they had burned as an aggregate $10000 \times 600 = 6000000$ hours

The lamps are considered as ~~burning~~ an equivalent to 12 candle gas; that is each one giving 12 candles may be thought as taking ~~and~~ equivalent of five cubic feet of gas for each hour ~~that~~ they are burned.

This unit is taken as it is found by experience that the devices by which the light may be made so much more ~~effect~~ practically effectual add so much to the apparent light that

every [illegible] is satisfied when told that it is giving a good gas jet. Also that gas cannot be burnt in practice so as to give out the maximum of light, shown by the photometer while the electric light ~~must give to consumer~~ ~~as much as~~ twice the ~~tester at the laboratory~~

of 12 candles of [illegible] [illegible] volts will give at least 10 to 15 candles of effective light as compared with gas

52.560 000

365
25
1825
730
9125

365
20
7300
7.200
146 0000
371
525 $ 0000

52560
225
262800
105120
10512
118.260.00

15,750
37.725
30 000
6.700
46 900
3 000
75 000
5 000
$ 220.075
110
$ 230.075
365
20.5
1825
730
7482.5

76~~011~~) 220.075) 76991.0 (34.9
660225
1096950
~~1000375~~
880300
2166500

330.~~42~~) 76~~999.0~~ (233
660
1099
990
1.090

220) 3757 (170
220
1555
1540
1.50

330) 3757 (114
330
457
330
1270

Menlo Park Notebook #111 [N-80-08-18]

This notebook covers the period August-October 1880. Most of the entries are notes, calculations, and drawings relating to tests of carbon lamps, commencing about 8:00 p.m. on October 6, 1880 and continuing until about 4:00 a.m. The entries are by Edison, Francis Upton, Francis Jehl, and other laboratory staff members. The few earlier entries also relate to lamp experiments. The label on the front cover is marked "Upton," "Oct 1880," and "Lamps Lot 1." There is an index on the inside front cover. The book contains 282 numbered pages.

Blank pages not filmed: 36-37, 278-279.

Missing page numbers: 235-236, 241-242, 253-254, 263-266.

Index.

TAE

Candle	Lamp No	
		~~20 Cells = L 64. R 64.~~ 20 Cells = 32. E. M. F. 223.
32	1388	This Lamp had at one of its clamps the carbon broken, thus only a small portion was heated we did not put it up then to test its candle power
	1389	This Lamp when we had a small current on broke, it must have a very poor vacuum
	1431	

½

No 1406 TAE

32C This wanted
18 ft of German Silver
wire to make it
32 C which Deg 222

No 1427

This Lamp required
8 ft when def
was 223°

Lamp No 1379

This Lamp broke
when there was a
very small current
on. It broke ~~at~~
near the clamps
it seemed as if it
had a poor vacuum

TAE

No 1574

This lamp was
brought up to 32 C
when it bust.
The carbon was
curved over so that
the carbon nearly touch
the glass, Def 223

1396

This Lamp was
without any Res
in The Circuit 28.5 C
Def being 223

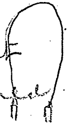
TAE

No 1360

This Lamp was at 32 C when adjusted so that it had 11 of the german Silver wire was put in, Def being 223. The carbon was curved.

No 1386

The carbon was split as shown and



when the current was put on it would arc.

Def 223

TAE

No 1435

This Lamp was at 32 C when Res adjusted so as to have 15 feet of German Silver ~~Sol~~. This Lamp was of German glass.

Def 223

No 1361

Carbon burnt.

This Lamp burst when only a small current was put on. Must have a poor vacuum

Def 223

TAE

No 1398

Bad Carbon. Three bad spots in it Did not test it.

No 1391

Bent Carbon

Bad Spots, one at the top, and another at the side near the clamp. did not test its C power

TAE

1382

This Lamp was at 32 C when it had 10 feet of German Silver wire Def 223.

refer also to page 16.

1380

This Lamp with 10 feet of german silver wire was at 32 C when def was 223

TAE

~~1373~~ 1428

Lamp at 38 C when
E.M.F. 223. 20 cells =
32.

One Chem put This
Lamp a 32 C & required
8 feet of G.S. Wire.
Def 225 L. R 228

No 1418

Lamp burst when
at about 48 C
Def. 225 L. R 228

TAE

No 1382

Lamp at 48 C required 5 feet of German Silver wire. Def 225 L. 228 R

refer also to page 12.

No 1424

Lamp at 48 C required 10 ft of G. S. Wire Def L 225 R 228

TAE

No 1395

Carbon Little Burnt
7 feet required to make
it 48 C when def was
225 L. R228

No 1421

This to make it
48 C it wanted 11
feet of G. S. Wire
Def 226 L. R 228.5

TAE

No 1423

Low Vacuum
Carbon oxizied when
small currents

No 1410

without Res 32 C
E lle 7. R 228 L 225

TAE

1420

feet to make it
32 C. a spot on one
of sides. Def. 225 L
228. R.

No. 1384

Carbon bent
at 48 C when it required
3 feet of G. S. Wire
Def R 230 L. 228

TAE

1433

Abt 48 C when it
had 3 feet of G. S. Wire
Def 225 L. 228 R.

To ~~1386~~ 1391

Little bent
This has two bright
spots, one on the side
and the other near
the clamp.
Brushed on the bright
spot on the side.

TAE

~~1386~~

Bad Carbon
burster at a low
current.

1422

EM7 223

put on at 9.15

one side seemed to be
a great deal brighter
than the other.
at 17 C 15 C

TAE

No 1440

5 mins Bass fiber was put in a nical mould and while white hot galoline gas was blown against it. I put it up at 48 C. was up at five minutes then the engine stop.

TE

In the morning put on at 48 C at 8.33

In the morning was put on again at 8.33 at 48 C

E M 7 = R 234. L 2.32

This Lamp bursted at 8.57

8.57
8.33
——
24
——
12

Making it 23 minutes that it lasted.

1

11-30 Blue running back one wire

11-36 reached the end of wire

11-38 commenced on other

 In gauge

11-40 Blue filling one side of globe

11-46 Reddish tinge. Just in tube, rapping in fall tube.

Aug 18.

This experiment with the four glasses (those which support the Carbons). The one which had the

White ends had a slight red phosphorescence and green ~~on the~~ at the glass. poor vacuum,

The one with plain glass had a slight red phosphorescence but poor vacuum.

After dark
Spark tubes alone

7.26 | Blue on one wire
7.33 | Glass green
Blue [illegible]

TAE.

34 | Completely blue on one wire, red on other wire
Just before tube
35 | dark around wire
1.36 | Commencing to spread on the other side light pink

7.37 | reddish pink on one side light on the other bands of pink glass bluish fluorescence,
Bands fading in [illegible]
7.39 | One wire light pink the other greenish. vac at 75

740	vacuum 78.
7-42	Vacu 85.
	two bands very light line.
7-45	Light blue [illegible]
	V- 90
	Vacuum soft went down to 78

Test on 100 lamps on table. Oct. 6, 1880

Lamps brought up to dull red and bad lamps picked out as follows

26. Spotted.
69 "
81 "
54 Bright at top.
100. " " "
44. arc. between clamps,
54 vac. gone, oxidized at top
99 # 28. # 66. carbon broken gone no light. never lighted in test - was busted in Jahls tests

73 - went in the clamp -
J Al

~~44 went finally put it~~

Res on 44 . burned out

44 had a bad contact
in clamp sometimes it
would make good contact
& loop burn OK then you
would see sparks between
the carbon & clamp &
an arc light blue 1/4
inch dia jump across
then it would make

3:04

36.

Geo k Cutand again
I so in a

one lamp brought
was just at red
while its neighbor
was giving about
8 candles; the one
that was red had
bad vacuum on feeling
the globe the 8 candle
was the coolest
Shewing Enormous loss
Energy by air Conduction

in a low vacuum

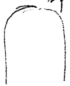
~~Res~~ time 8 oclock 5 min
53 - abnormally high ~~blue~~
95 Little higher that
ought to be -

~~Started~~ 8,05 PM
EHgs watch
8.12 by clock -

✓54- went at top

Split

split.



~~[illegible]~~ one mins =

0.1 degree) -

TAE

✓58. went at top 10 min

at 8.27 we found EMF Not quite right. took EMF from wires on table & brought it up 2 Volts more than the right amount to allow for heating of Res Coils

Nate See p 53

52 low.	
53 abnormally high	
51 fair.	68 fair
55 "	69 fair
56 "	70 fair
59 fair	72 fair
60 fair	74
62 } fair	76 fair
61 }	77 - fair
63 High	78 "
64 fair	79
65 Extra fair	80 - fair
	81
67. fair	83 - very poor H.G. bluish clay

✓ 49. went in Carbon -

[illegible]

26 minuts to 9.

8.34 PM

✓ 53 - went in glass

8.34 ½

22 ½ min Total Time

84 - good
85
86 } fair
87
89 - little low
90 "
91 fair
92 little low
93 low
95 very bright
96 - fair
97 - fair
98 "
100 - low

KG

See p 61

1 fair
2
3 high
4 high
5 fair
6 High
7 high
8 High
10 fair
11 good
12 good
13 fair
14 high
15 fair
16 fair
17 low
18
19 fair

20 low
21 very poor
22 fair
23 fair
24 little high
25 fair
26 bent Fold spot
29 pretty high
30 low
31 Low
32 fair
33 fair
34 fair
35 fair
36-7-8 – fair
39 high

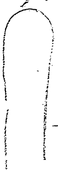
No. 95 –

top

8.39 pm

total 27 m.

9 ks



68 – went

8.41 pm

total 29 m.

Nov 26 - went 841 - it
had bad spot - when it
went it goes an arc as
it burned its vessel
Coil - TAE

total time 29 m

40 fair

41 fair

42 fair

43 pretty fair

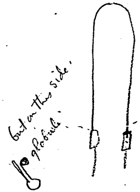
45 fair

46 fair

47 little high TAP

48) fair
50)

32 - Busted in Carbon
time - 8.52 pm-



(Sic! Carbon vapor oriented by polarity gives the arc)

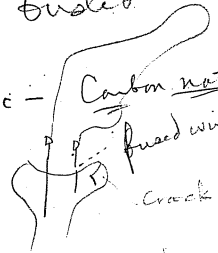
plat clamp it
The was flue on clamp—
investigate see if it actually a plat clamp—

~~total~~ Time 40 m.

This shows that an arc passed as the globule was on the clamp where Carbon united + the Real Coil burned out at moment of busting carbon

24 - time 8.56 pm

busted TAE



Arc - Carbon not busted

fused wire at glass

crack in glass

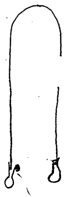
Risio burned
luna

plat clamps

~~[illegible]~~ no black on clamps
dont think there was blue, Evidently
the glass cracked let in air & an arc
sprung & burned the wires ~~the~~ over

The arc being below the carbon saved it + the platina being in partial vacuo of course got to melting point before pt outside in air

✓ 69 – went at 9 oclock



busted bus. TAE

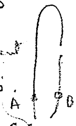
arc sprung –
~~burst~~ resistance

List of those blue at Clamps at 903 —

97 -	80	50	
18	34	64	
20	79	62	
23	35	60	very little
25	76	57	
83	37	52	good deal.
29	39	51	
31	71		
33			

TAE

No. 4 busted 9.08



The Carbon is broken & dropped down but cant say if it was by Current

wire melted at glass. Res. burned out shewing arc

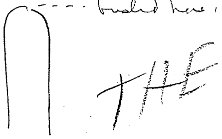
a clamp was [illegible]

~~but don't see how arc [illegible]~~

doubtful?

~~the Carbon [illegible]~~ Think where the arc was from

37 - busted 909 -



THE

No 3 busted 9.21 - pm
busted in glass - arc
Resistance burned
plat clamps - no
black on them.
plat was not burned at
glass still standing

TAE

No 14 Busted 922

arc-Res burned

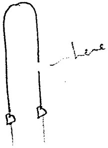
block on one clamp &

plat-wire burned at

glass

TAE

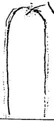
39 - busted at 926



THE

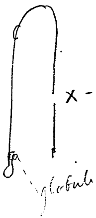
6 busted at 9-34

The resistance burnt first
then the carbon oxydized
all over gradually 5 sec.



No 10 - at 939 pm
Busted in glass
Resistance burned
Carbon glass etc all
limped -
plat clamps OK
After test side of clamps
black at all

No 12 - at 9.46 pm -



TAE

arc across + busted Carbon at x

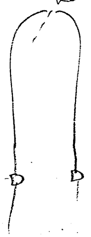
Resistance burned

no black on clamps which are of platina.

No 35 9.47. pm busted

had bad spots uncommon all the time

busted here TAE



Shows shining Carbon on parts of loop by Carrying

No 9 at 9.54

[illegible]

~~Coarse~~ Large bamboo

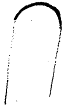
platina clamps
no black on them   TAE

arc sprung Res
burned

plat wire burned at
glass — Crack across
also

Think carbon was broken
mechanically

I notice in looking through blue specs that quite a number are brighter around the loop



these

TAE

also some few are bright near clamps

---

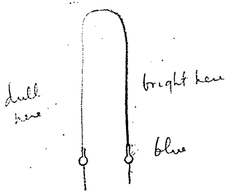
72 busted at 10,03 pm

platina clamp

had bad spot near clamp was rather high. arc sprung & melted plat $\frac{1}{4}$ below clamp

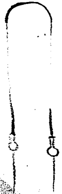
No 7

I notice No 62



TAE

I notice No 33 · is 1k



✓ No 7- 10.09 pm

Went.

TAG

✓ No 33 – Went at 10 15 PM

Split on Carbon but not busted

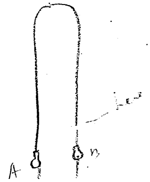
Lampblack on spring

TAE

Arc sprung Resealing burned –

But put other Res in w/ [illegible]
Cop wire when it
became incandescent & arc
sprung glass busted

No 13 at 1016 -



TAE

flat clamps
just slightly [illegible]
in A side

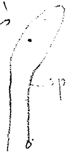
Res [illegible]

82 — 1019 pm —

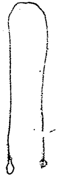
Busted in glass all went to pieces.

TAE

Insulate this



No 2. 1020-pm



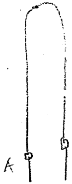
little smoked in glass

TAE

plat clamp with block

Resistance did not burn

No 8. 1022 pm

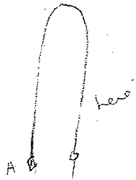


— here little blackened in globe

platelamp TAE?

Exceedingly slight tinge black on A.

No 63 — at 1025

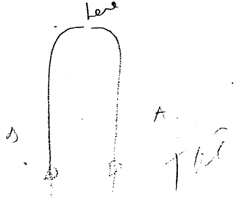


1 Ni

plat clamp Ro OK

plat clamp at A very black

62 busted at 1031



Nickel clamps Res OK.

Dont appear to be any black on clamps but notice black on thick part of carbon & a polished carbon carrying

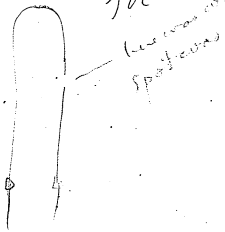
This was the lamp that was bright on A side & Dull on B

76 - at 1033',

had a spot. this spot kept on for about hour suddenly grew big in 5 sec, Vapor of Carbon shot out arc sprung

Rec Burned

TAE



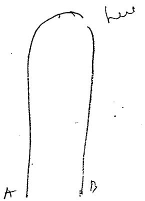
1041 we stopped to fix
brushes started again
at 1050 -
9 - minutes to
be subtracted -

---

56 busted at 1054 TAE

Larger end was split in clamp
probably made bad connection
as arc sprung & burned
Resistance, but carbon
intact

No 67 — busted at. 1056.



TAE

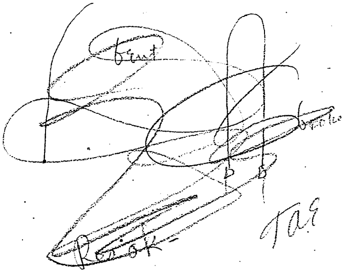
Nickel clamps - A very
very black B somewhat black.
arc sprung Res burned

I notice that the Extra bad Vacuum Lamps have their Carbons very much bent over these dont give more than 4 or 5 — Candles. (theres only two -

There is not one Carbon in the whole except the above two that is not ~~straight~~ Enough & the great majority are quite straight =

TAE

No 64 = at 11 13 pm



TAE

broke there

Nickel clamps check
No Res in this one

11 25 pm

Blue at clamps

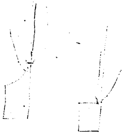
50	81
48	80
45	71
34	61
31	60
30	59
29	57
25	55
23	52
22	51
20	
19	
18	
100	
98	
97	
83	

TAE

19 & 22 doubtful Gabe didnt take water about blue first 20 or 30 clamps

~~got~~

- 10 19 22 45
48 81 55 have
got blue since last taking
blue on page 69 —



79 - at 1128.

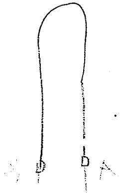
TAE

Carbon was intact.
but could see that it was
badly split at clamp
+ clamps were both
~~[illegible]~~ black slightly
kind of bluish oxide -
arc sprung - Resistance
burned out.

Quantity
200 -
dif Emf between 1 ohm + 200 ohm lamp
16 candles no against 48,

vac
82/100 at 48
67/100 at 16 -
Then there dif
incandescence

61 Busted at 1150



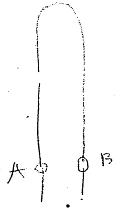
TAE

Nickel dep - Spr of lamp
black on clamps on both
most on A.
Resistance 5K

Some doubt being Expressed that the lamps (1e) majority were at 48 candles I took out a lamp in Res. that looked like 30 to 35 of the majority were 48 & measured candle power down stairs. No was. 80. Took off at 1155 put back at - 1205 am - measured 35 candles

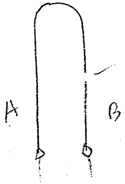
No 20ᵁ 1155 TAE

Res OK



nickel clamps block at A. being carrying Shunning Carbon one side (1e) A. Carbon on B side Block -

No 30. at 1150.



TAE

Shining Carbon on A side black on B Side.

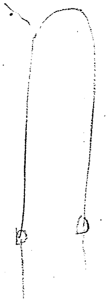
A clamp full Lampblack

Some on B . . .

arc (slight) must have sprung

Resistance Lowered little

No 70 at 1158

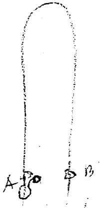


TAE

plat clamps
dont appear to be
block at all
Resistance Not burned

52 busted 1201 AM-

Arc spring



TAE

platina

Nickelclamp blade on both-

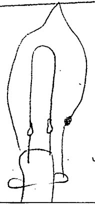
Resistan burned-

The ones that have no blue are at 1210

		17
96	78	16
93	77	15
92	75	5
91	74	1
90	65	
89	47	
88	43	
87	42	
86	40	
84	36	
	21	

TAE

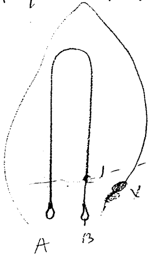
Phenomena.



Spot here on 96 as nickel clamp is very close to glass perhaps it is oxide from clamp

See 132 Page

No 78 1216 AM.



TAE

saw while incandesct
a spot here giving
off vapor Carbon in
straight line. this
vapor impinging on
glass gave the spot
x which I suppose
was due to nickel
as set forth on page
132 - The arc
suddenly grew
large & then
abnormally increased
formed Resistance
the side A or clamp
when Carbon broke
was white hot
Carbon brushed when
saw bright spots

57-' at 1220 -

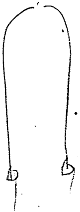
Exploded like a
pistol -

TAE

No 100. 1235 am

Burned splendid & high
all Evening got spotty
last hour went at top

TAE

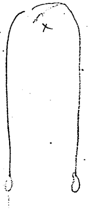


Carbon ~~patty~~
shiny showing
Carrying pbly
due to these spots

Nickel Clamps
has black spec
Lamp black

Res OK

25 1247 - AM



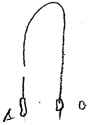
black on both clamps

TAE

x is a splint covered with
Lampblack = rather smallered
on glass - Resistance OK.

74 - at 1250

TAE



nickel block on
clamp A

glass cracked

Kovatrn burned

trunk split in clamp

plat wire burned off on B side

83 at 1252 =

Bad one Cut touched glass then burned hole + oxidized all up - no R in

---

TAE

47. ✓ 1,02 am -

~~plat clamps~~

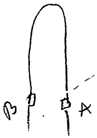
Res burned

burned off plat.

wire 1/4 inch from

Clamp on B side

FAG

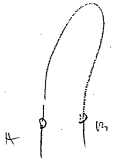


dont know if it was broken by current or mechanically

one clamp slightly

broke very slightly

31 ✓ at 103 am

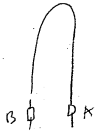


Showing carbon on
a side
also on B but there
some black
spots

Res OK 151 am TAE

Lampblack on B
Clamp

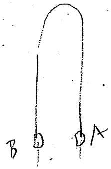
42 at 105.



Res burned arc.
~~plat clamp~~
both bright
~~burned platin~~
at glass. on A side

TAE

59 — at 116 —



Res burned
arc spring

Lamp black
all over glass in
specs

A clamp very black

Has Mercury in globe

JWL

128

69) 61.9 (
470
660
660
660
660
39

at 1.20 AM -

I pick out No 65 & Francis take it with its reservoir down stairs to see if it is really 48 Candles = as a 48 candle lamp

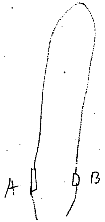
after taking it off I noticed globe somewhat blackened but then there had been blue all over globe for some time = measured 30 Candles but think that the blackening of the glass made big difference

We take at 1.37 No 91 which appears very bright & find it to be 31 @ 2

Put 65 back at 1 40 am

46 at 130

Co



Res burned
arc sprung

A clamp
very black

Small End of screw on A
clamp fused

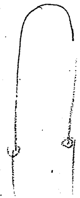
TAE

Apparently these lamps
are about 30 candles
instead of 48 = I dont
believe that they have
been any brighter than
they are now & from these
test ~~& judgement~~ its
apparently as 30 candles
for the brightest =

TAE

19 — 155

Lamp black specs
all over glass Res
burned arc'd
both clamps-nickel
blued-



TAE

at- 1-35 probably ~~135~~ am we

put No 91 which was

31 @ 32 Candles to 48

candles + brought all

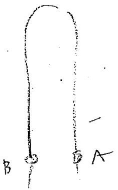
the remaining lamps

to that EMF which

was 178 Volts.

TAE

No 55 145 am

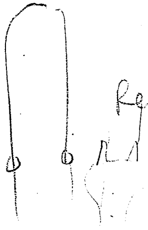


A very black

Res o/c B. Slightly

TAE

96 ✓ 1 50 AM



Rgo ok

R1

TAE

plate clamps
both bright.

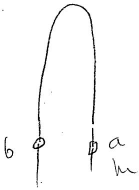
at 2 04 am

we Read blues at clamp
with 178 EMF or Volts

17	51	89
18	60	93
22	71	97
23	75	98
29	80	
34	81	
41	85	
45	86	
48	88	
50		

TAE

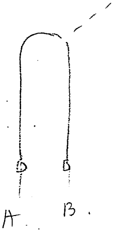
No 60 at 212 am



nickel clamps
Specs Lampblack on
a no Reco in
ckt

TAE

No 41 - at 213 am

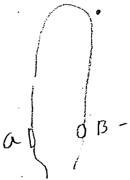


nickel clamps
B. block.

Res OK

TAE

84 at 215

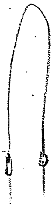


Res ok

arc, - Wire (platina)
of .B. melted at
glass

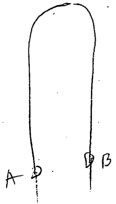
TAE

65 = at 216 am



plat clamps bright. The
Res burned
by arc. Glass
nearly brown

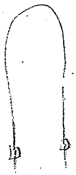
71 ✓ 216½ am.



Restarted
arc
TAE

A very black large feathers
of lampblack thrown
over on glass

Nov 15 at 230 am



plat clamps

Res OK

This is a clean straight The

& to be expected but

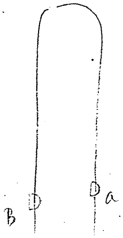
of the carbon

No black on clamps

at 230 am . 6 hours & 20 minuts
from start 33 lamps still
going out of 97 that started

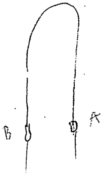
TAE

51 at 235



specs Lampblack
thrown on glass
Res Governed
Specs Lampblack
on a & B Governed
better Lampblack
TAE

No 22 237 am



Res burned

A clamp nickel
very black

Mercury in globe

B clamp browned

TAE

Carbons busted lowards + connected to Zinc pole

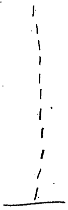
15

15
19

34

Lowards + connected to Copper pole

N



11

TAE

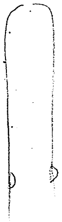
No 16. 243 am

Res OK

flat clamps no
black

broke as it showed in
Carbon TAE

21 247 am-



no Res
Low [illegible]
[illegible]
[illegible]

TAE

29 lamps alive at 3 oclock.
178 Volts last

38 at 310.

Split in Clamp

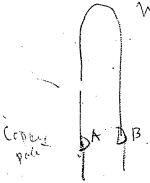
Arc went but didnt
Singe Res - one clamp
got white hot & in
3 seconds glass broke
& busted Carbon
all pieces mechanically

TAE

No 18 322

Shiny Carrying
Specs Lamp black on
nickel clamps

Res OK



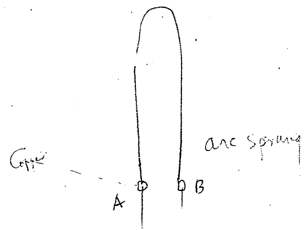
Carbon block
B side -

Shiny Carbon A side

TAE

81 — 3 31 am

Res turned



A very black in nickel clamp — TAE

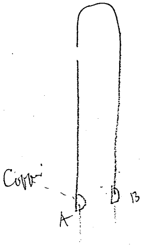
Carbon at A apparently a little loose in clamp.

50 - 334 am

arc - Resburned
platinum melted
at glass
Carbon so broken
Can't tell

TAE

97- 334½ am



Res not burned

Little black on nickel clamps

spots Lampblack thrown on glass near broken filament of it hanging to Carbon near break.

TAE

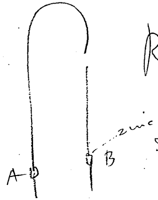
with the 178 Valts
No 91 has fallen
from 48 Candles at 2 oclock
to - 39 Candles at 356 am Showing
~~that~~ air Comes out &
reduces economy Even
after it has been at 48 -

They now use 91. &
~~increase the valts~~ to
____ & bring 91 to 48
Candles again - and all
the other lamps come
up with it -

TAE

23 lamps burning at 4 am

85 at 404 am



Res ok

Specs lamp black or bug on glass near break

A block in clamp

TAE

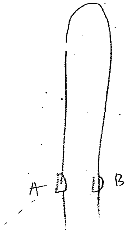
91 = J was changed on poles

Busted 8,10, am

positive side

Res OK - no arc globe clear

34 = at 350 am



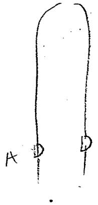
Carrying Shiny Carbon on B side

A zinc block

Res OK

TAE

80 ✓ at 406



Res OK.

Carrying + Showing Carbon on A Side.

A-block nickel clamps -

TAE

Put on

No 1

Busted 4.35 am

negative

glass clean

Res OK -

~~47 Lot 1~~

~~1.30 P.M.~~

~~Res burnt.~~

Stopped at

Nos These Lamps are to be taken off & tested for Economy

47 ✓ 17 ✓

45 ✓ 86 ✓ 98 ✓

43 ✓ 87 ✓ 1 ✓

40 ✓ 88 ✓ 5 ✓

36 ✓ 89 ✓

75 ✓ 90 ✓ 91 ✓

~~33~~

92 ✓

93 ✓

TAKE

put these lamps down to yellow & found 12 perfect No Spots

Platina	Nickel	Res Burnt	Bad	
24		/	/	[illegible] not bad but wire burnt [illegible]
	25			
	26	/		
Whole ~~white deposit~~	~~29~~		~~/~~	Whole white deposit on carbons
	30	/	/	White deposit on carbon
	31		/	
32	[illegible]	/	/	
[illegible]	34		/	
	35		/	
37			/	
38			/	
[illegible]	39		/	
	41		/	
42		/	/	
	44	/	/	

Platina	Nickel	Res Burnt	Bad
no 2			/
no 3			/
no 4		/	/
no 6		/	/
no 7			/
no 8			/
no 10		/	/
no 9		/	/
no 12		/	/
no 13			/
no 14		/	/
no 15			/
no 16			/
~~no 18~~	no 18		/
	no 19	/	/
	no 20		/
	no 21		/
	no 22	/	/
Marked not in the book white deposit on carbon	~~no 23~~		/

TOP

Platina	Nickel	Res Burnt	Bad
	46	/	/
	48 (?)		/
	49		/
	50	/	/
	51	/	/
	52	/	/
	53		/
54			/
	55		/
	56	/	/
	57		/
	58		/
	59	/	/
	60		/
	61		/
	62		/
63			/
65	64		/
		/	/

[illegible]

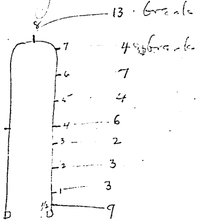
Platina	Nickel	Burnt Res	Bad
	67	/	/
68			/
	69	/	/
70			/
	71	/	/
72		/	/
	73		/
	74	/	/
	76	/	/
77		/	/
	78	/	/
	79	/	/
	80		/
	81	/	/
	82		/
	83		/
84			/
[illegible]	85		/

(64?) [illegible]

Tot

Platina	Nickel	Res Resist	Bal
	95		1
96			1
	97		1
100			1

Analyses



The breaks occur on both sides but I have marked them all on one side

HWG

	Volts	Ohms	Lt. Cls.	min
1	147	188	5090	
2	143	172	5260	
3	152	188	5440	
4	137	154	5400	
5	140	167	5200	
6	154	195	5380	
7	158	188	5880	
8	156	180	5990	
9	156	182	5910	Carbon broken
10	143	178	5090	
1	143	177	5120	
2	156	209	4920	
3	141	183	4810	
4	148	195	5040	
5	146	177	5340	
6	137	169	4920	
7	142	179	4990	
8	143	204	4440	
9	146	~~180~~ 179	5480	
19	27.68	3464	99700	

TAE

	Volts	Ohms	M-Vo
20	154	201	5230
1	~~too~~	high	—
2	140	168	5170
3	140	172	5050
4	160	239	4750
5	142	158	5656
6	154	191	5500
7	~~Broke~~	~~in testing~~	
8	Broke	in	testing — 0
9	142	168	5320
30	142	158	5656
1	154	211	4980
2	160	196	5780
3	162	233	4.996
4	148	189	5130
5	164	223	5240
6	144	183	5020
7	148	185	5250
8	128	177	4230
9	152	172	5950
20	2334	3224	99008

TW

	Left margin	Volts	Ohms	44 lbs.	Notes
40		134	163	4888	
1		148	208	4660	
2		148	192	4850	
3		138	171	4930	
4	0	156	202	5340	0
5		144	212	4320	
6		142	177	5046	
7		140	171	5677	
8		142	163	5480	
9		174	213	6296	26
50		158	206	5437	
1		146	180	5246	
2		168	192	6516	
3		132	182	5623	oxydized 10
4	100	~~too~~	~~high~~		
5		164	198	6017	
6		160	201	3642	
7		164	188	6348	
8		Broke in testing			
9		148	194	5001	
20		2706	3413	96537	

0

103151
5157.

	Volts	Ohms	Ft lbs	
60	146	214	5706	
1	156	179	6022	
2	158	212	5216	
3	152	191	4918	
4	160	233	4867	
5	149	168	5317	
6	156	198	5448	Carbon broke
7	152	207	4944	~~carb~~
8	162	217	5357	
9	144	194	4735	
70	150	201	4954	
1	144	169	5435	
2	150	200	4983	
3	162	231	5033	
4	154	200	5253	
5	134	162	4910	TAE
6	150	199	5008	
7	146	197	4800	
8	144	191	4810	
9	156	210	5130	
20	3038	3973	103151	

Lamps	Volts	Ohms	Ft-lbs
21	2490	3062	82255
20	3038	3973	103151
20	2706	3413	96553
20	2534	3224	99008
19	2708	3464	99710
1[illegible]	13476	17136	480651

9 Bad

92

13476/146

92/480651/5224

92/17136/186

146 average in Volts.
186 " " Ohms
5224 " " Ft-lbs.
No of Lamps 92 good

	Volts	Ohms	Ft-lbs
80	144	182	4840
1	146	198	4778
2	Too high		
3	Too high		
4	136	167	[illegible]
5	138	168	5030
6	138	179	4720
7	138	171	4960
8	136	175	4430
9	142	203	4352
90	124	164	4053
1	132	160	4825
2	146	183	5242
3	152	200	5117
4	Broken testing		
5	140	178	4877
6	142	185	4828
7	140	167	5199
8	144	171	5371
9	Broken		
100	152	204	5017
21	2490	3062	82255

TAE

Average of the 91 lamps tested

13476 4.1294

91 lamps 1.9590

2.1704

148 Volts

17136 4.2336

1 1.9590

2.2748

188.2

480641 5.6818

1.9590

3.7228

5282 4.5185

.7957

6.2 per H.P 1.6812

46 2.4769

300 candles per H.P.

TAE

 Total Ohms

24 | 3968 | 165

24 | 116003 | 4833

24 | 3174 | 132

Average Ohms 165

average in Foot Pounds 4833

average Volts 132

with 24 lamps Poles of the clamps.

Averages of 21 Lamps with blue on the clamps.

Total Volts.

21 | 3174

151 Average.

Total Ft lbs.

21 | 116003

5523 Average.

Total Ohms.

21 | 3968

188 Average.

~~Blue at~~

Lamps	Minutes
58	– 10
49	– 22
68	– 28
82	– 40
37	– 57
39	– 74
76	– 142
61	– 209
20	– 214
30	– 215
52	– 220
51	– 239
10	– 254
25	– 266
83	– 271
31	– 282
59	– 295
19	– 314
55	– 324
60	– 351
71	– 356
51	– 374
22	– 376
21	– 385
18	– 421
81	– 440
50	– 443
97	– 444
34	– 459
80	– 475
30	

Ruled by FRU

Total Lamps

0 - 100 minutes — 15 — Total Time 163 — 208 — 77. Cts 5725

100 - 200 minutes — 12

200 - 300 minutes

TRE

22159

Average burning time of 82 lamps which did not last of first lot from the factory.

Total no of min 22159.

" " " Lamps 82

Average ——— 270 min

~~Three~~ Six lamps lasting at about 700 min = ~~2~~4200 ~~Horses~~ which added to the total makes the

Grand Total, ~~24259~~

Total No of Lamps. ~~51~~ 88 lamps

Average — ~~[illegible]~~ min.

22159.

299

Refer to Page 247

T.A.E.

43 lamps that were blue at the clamps out of
38

Unaccounted for

23
~~[illegible]~~, 11, 27, ~~[illegible]~~, 29, 44, 48
~~[illegible]~~, 73, 94, ~~[illegible]~~

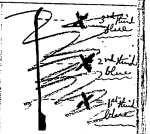
8 lamps
3 lamps broken at first

11 lamps

89 lamps to be accounted for

On table 89

No of Lamp	not Blue	1st third	2nd "	3rd "	No of Lamp	Not Blue	1st third blue	2nd "	3rd "	No of Lamp	no Blue	1st third blue	2nd " blue	3rd " blue
□ 1	0	0	0		□ 40	0				✓ 80		0	X	X
✓ 2	0				✓ 41	0				✓ 81		0	0	X
✓ 3	0				+ 43	0				✓ 82	0			
✓ 4	0				~~44~~		X	0	0	✓ 83		0	X	X
+ 5		0	0	0	+ 45		0	0	X	✓ 84	0			
✓ 6	0				✓ 46	0				✓ 85	0			
✓ 7	0				□ 47	0				+ 86	0			
✓ 8	0				~~48~~		0	0	X	+ 87	0			
~~9~~	0				✓ 49		X	0	0	□ 88	0			
✓ 10	0				✓ 50		X	X	X	+ 89	0			
~~11~~	0				✓ 51		0	X	X	+ 90	0			
✓ 12	0				✓ 52		X	X	X	□ 91	0			
✓ 13	0				✓ 53	0				+ 92	0			
✓ 14	0				✓ 54	0				+ 93	0			
✓ 15	0				✓ 55		0	0	X	my error ~~94~~	0			
✓ 16	0				✓ 56	0				✓ 95	0			
□ 17	0				✓ 57		X	X	X	✓ 96	0			
✓ 18		0	X	X	✓ 58	0				✓ 97		0	X	X
✓ 19		0	0	X	✓ 59		X	0	X	+ 98		0	0	X
✓ 20		0	X	X	✓ 60		X	X	X	✓ 99	0			
✓ 21		0	X	X	✓ 61		X	0	X	✓ 100		X	0	X
✓ 22		0	0	X	✓ 62		X	X	0					
~~23~~		0	X	X	✓ 63	0								
✓ 24		0	X	0	✓ 64		X	X	0					
✓ 25		0	X	X	✓ 65	0								
✓ 26	0				66		X	0	0					
~~27~~	0				✓ 67	0								
28	0				✓ 68		X	0	0					
~~29~~		0	X	X	✓ 69	0								
✓ 30		X	0	X	✓ 70	0								
✓ 31		X	0	X	✓ 71		X	0	X					
✓ 32		X	0	0	✓ 72	0								
✓ 33		0	X	0	~~73~~		X	0	0					
✓ 34		0	X	X	✓ 74	0								
✓ 35		X	X	0	+ 75	0								
+ 36	0				✓ 76		X	0	0					
✓ 37		X	X	0	✓ 77	0								
✓ 38	0				✓ 78	0								
✓ 39		X	X		✓ 79		0	X	0					
											56	22	22	25



not blue 0

refer to Pages
69 - time 9.03 P.M.

Page 117
11.25 P.M.

Page 131
12.10 P.M.

TAE

(was found to be)

Summary Lot 1

The average of all the
91 lamps tested pp. 221 — 231

Volts	Ohms	Foot lbs
148.	188.2	5282.

That is 300. candles were
obtained per Horse power

Record was kept of 89
lamps the average burning time
~~being~~ 310 minutes
38 lamps were blue at
the clamps. The average
of 27 of these gives

Volts	Ohms	Ft. lbs.
157.	152	5352

TAE

The average burning
time of th

88 lamps 22159
No 40 = 1350
" 47 = 1050
" 1 = 745
" 17 = 703
" 90 = 790
" 96 = 706
27601.

Average time of burning
of 82 Lamps which burnt
their Resistance coils.
~~On Minutes~~

Average burning time of 82
Lamps which did not go of 1st
lot from factory
Total No of Min = 22159
" " Lamps = 82

Average = 270 Minutes.

Also 6 Lamps which lasted
about 700 Mins = ~~[illegible]~~ Minutes
which added makes a grand
total of = 26359 which
gives an average of the
88 Lamps of 299 minutes

82 l. 22159
1350
1050
745
703
790
706
89 l 27601 Total Min.

Average for 89 lamps
310 Min

JAR

Lot 41.

Lamps that broke in the succeeding 50 minutes.

	During the time	Total	%
0 - 50	10	10	11.1
50 - 100	9	19	21.3
100 - 150	11	30	33.6
150 - 200	4	34	38.1
200 - 250	7	41	45.9
250 - 300	8	49	54.9
300 - 350	4	53	59.8
350 - 400	10	63	70.7
400 - 450	5	68	76.3
450 - 500	6	74	83.4
500 - 550	1	75	84
550 - 600	2	77	86.5
600 - 650	3	80	90
650 - 700	3	83	93.4
700 - 750	3	86	96.6
750 - 800	1	87	97.7
800 - 850	0	87	97.7
850 - 1000	0	87	97.7
1000 - 1050	1	88	98.8
1050 - 1300	0	88	98.8
1300 - 1350	1	89	100

TAE

Lot No 1

Time	Nos	Perct	Time	Nos	Perct
from 0 to 50 minutes	54 58 49. 53 95 68 26 32 24 69		from 150 to 200 minutes	56 67 64 79 33	$39\frac{2}{7}\%$
from 50 to 100 minutes	4 10 37 3 14 39 6 10 12 35. 19	$11\frac{19}{21}\%$	from 200 to 250 minutes	61 20 30 70 52 78 37 40	$47\frac{13}{21}\%$
from 100 to 150 minutes	72 7 33 13 82 2 8 63 62 76 29	$= 21\frac{3}{7}\%$ $34\frac{11}{21}\%$	from 250 to 300 minutes	100 25 74 83 77 31 42 39 48	$57\frac{1}{7}\%$
			from 300 to 350 minutes	46 19 55 96 .52	$61\frac{19}{21}$

JMG

(over)

Blotting the next Page

worn out by Dummy

Nos	Time	Per cent	Nos	Time	per cent
60		from 500 to 550 minutes	45	74	88 2/21 %
41					
84		per cent			
65	from 350 to 400 minutes	from 550 to 600 minutes	75		
71			93	76	90 10/21 %
15		per cent			
51	per cent 73 17/21 %				
22					
16		from 600 to 650 minutes	90		
21			92		
62		per cent	5	79	94 1/21 %
38	from 400 to 450 minutes	from 650 to 700 minutes			
18			36		
81			89		
50			98		
97	per cent 79 16/21			82	97 13/21 %
67		per cent			
34	from 450 to 500 minutes	from 700 to 750 minutes	91		
85			17		
80				84	100 %
87					
43					
86	per cent 86 19/21				
73					

Tal

48 candles · ~~going yet - 9.45 pm~~

(1421) Muffle pretty high - higher than ordinary bad spots
new way clamping. Vac. high
4 hours 10 min

48 candles
1424 ditto 3 hours 30 mins - new clamping
no spots - Vac High

48 candles
1382 - gas f carbonization 1.45 no spots high Vac
old clamping - 1,45

32 candles
1427 = Muffle f = higher than ord - bad spots high
Vac - new clamping - 2 hours 13 min -

48 candles
(1384), gas furnace - no spots split in clamps =
going yet 745 pm - burnt very much.

48 candles
1395 = gas furnace — 2 hours 13 minutes clamped old
no spots - high Vac : lasted 2.13

32 candles -
1428 - muffle high heat - bad spots high Vac.
Corrugated clamped new way - 3 hours

32 candles
(1380) gas furnace - old clamping no spots
high Vac - on yet 750 -

32 c
1360 ~~Ca~~ gas furnace — Corrugated till
touched glass - no spots split in clamps
Vac 95 old clamping 1 hour 35 min -

32 C
1435 - Muffle high heat - clamped new
way - German glass = no spots - not
best good = on yet 752 - pm -

32 .C.
1420. Muffle high heat - new way clamping
bad spot - high Vac - 2 hours 20 min

32-C
1406. Muffle intense heat - old clamping
glass buckled, no spots high Vac
3 hours.

48 c
1433 - muffle high heat - bad spots high
Vac 1 hour 15 min.. new clamping

32 c
1410 ~~Muffle~~ gas furnace then put in Muffle at
intense heat 11 minutes - high R - bad spots

TAE

Summary of Lot 1 TOR

The average of all the lamps tested (91) to be found on pages 221 to 231

Volts.	Ohms.	Foot-lbs.
148.	188.2	5282

That is 300 Candles per Horse Power were obtained

From the record kept of 89 lamps the average time of burning was found to be 310 minutes

Thirty-eight (38) lamps were blue at the clamps the average of 27 of these gives.

Volts.	Ohms.	Foot-lbs.
151	152	5352

Nothing important on next 2 pages
torn out by Hammer.

minutes
82 / 22041
268 average for 82 lamps
of Lot 1

22041
1350
1050
745
703
790
701
103
89 / 27483

minutes
308 average for
89 lamps.

TP

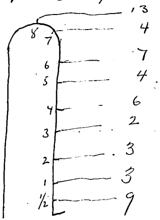
Average time of burning of 32 lamps
in first test which burnt their resis-
tance 198 minutes.

On page 249 is the table showing the number of lamps that gave out during the succeeding 50 minutes.

On page 219 is an analysis of the places at which the lamps broke

51 lamps

TAE



On pages 243 is
a table showing the
lamps that showed
blue at the clamps

TAE

Result.

These lamps were made with very poor vacuums and in a number of cases the sealing of the wires through the glass was defective. The wire was simply run through the glass of the inside part which was sucked in.

The lamps that TA lasted the longest were those which took below the average E.M.F. to bring them to ~~the~~ 48 candles.

Lamp. 40 which lasted 1350 minutes showed at the end of that time no

slackening on the clamp
It was tested twice for economy and was found ~~the~~ to be a fraction less economical at the end of the test than at the beginning though practically the same. The resistance and E. M. F were also practically unaltered. This shows that when the lamps are sufficiently exhausted that they are permanent.

All the lamps that were blue at the clamps at the beginning of the test gave out before 700 minutes.

TAE

Lot 1 – Test lamps.

No.	Volts.	Ohms.
16	133	177
17	145	179
18	141	193
19	123	188
20	199	213
~~21~~	~~too high.~~	
22	120	168
~~23~~	~~[illegible]~~	
~~24~~		
25	122	180
26	132	269
29	120	177
30	127	166
31	155	223
32	141	206
33	136	194
34	126	197
35	157	232
15 lamps	2077	2962

Volts.

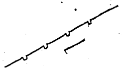
15 | 2077 | 138
15
57
45
127
120
7

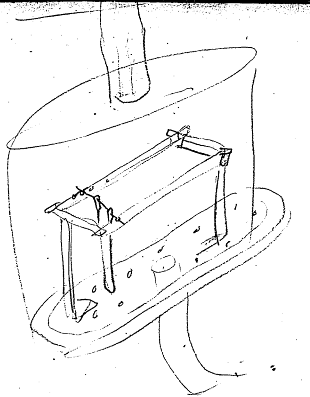
15 | 2962 | 197
15
146
135
112
105
7

197 Ohms

138 volts

TAE





TAE

2 2

33) 2850 (8.6
264
210
198

33) 267 (7

33) 250 (7
231
19

33)267 (8

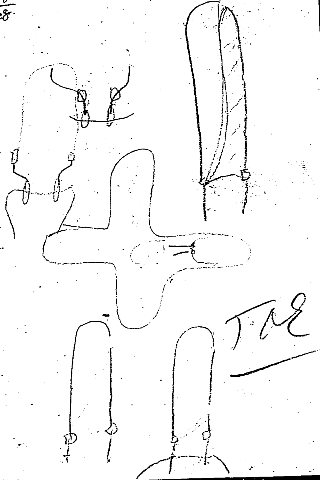
21.6
8.6
1296
1728
185.76

21.6
7
151.2

33)264 (8

21.6
8
172.8

33)268 (8



Menlo Park Notebook #112 [N-80-07-23]

This notebook covers the period July-August 1880. Most of the entries are by Francis Upton. There are also a few entries by Edison. The material relates mainly to tests of carbon lamps. Included are a few notes and a table relating to faults that were found in the lamps, based on the experiments recorded in Notebook #103; notes and occasional drawings relating to tests of six-inch bamboo carbon lamps, along with a table of results; and a record of bets among the laboratory staff on the life of the lamps being tested. There are also notes relating to the burning of kerosene lamps in order to determine their cost; and notes on conductors, dynamos, meters, lamps, and wiring for the Menlo Park distribution system. The label on the front cover is marked "Upton" and "Lamps." The book contains 284 numbered pages.

Blank pages not filmed: 4-5.

6" Bamboo Table p 163
Page 69 - 75
87 - 123 - 125 - 131
133 - 137 - 145 - 149

Kerosene oil test p 213
Kerosene at 22cts per gallon
cost 80cts per M

1300
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
7
8
9
20
1
2
3
4
5
6
7
8
9
30
1
2
3
4
5
6
7
8
9
40
1
2
3
4

1345
6
7
8
9
50
1
2
3
4
5
6
7
8
9
60
1
2
3
4
5
6
7
8
9
70
1 221
2 225
3 233
4 241
5
6
7
8
9

1380
1
2
3
4
5
6
7
8
9
1390
1
2
3
4
5
6
7
8
99
1400

THE

Questions

Does a lamp appear to give more light in the evening than in the day time?

Does a lamp change its resistance after it has been brought up once very high?

The relation between the the temperature of the lamps and their permanence

Try a number of lamps very high on pumps

THE

Lasted

[illegible] [illegible] 101, minutes

Bast	Paper #	Bamboo
Lasted minutes	3 minutes	lasted minutes
9		$11\frac{1}{2}$
14		9
2		1 hour & then took away
2		22
13		52
7		2
1		1
12		5
5		1
2		2
		26

TAE

11 131

10 67 6

at Candles	Ohms	Ohms
15.5	146.9	108.3
16	142.4	122.9
15.5	127.6	112.9
16.	109.6	97.1
17.5	125.1	114
16	140.9	120
15.5	129	111.4
16	118.1	104.9
17.5	99.1	91.2
		89.4
16	160.4	145.4

Results from Book 103

	page	ft. lbs	Lasted
Bamboo	255	3900	26 minutes
Bamboo	231	4150	5
Bamboo	225	4300	12 m
Bamboo	217	4350	52½ m
Bast	199	4640	7 m
Bast	239	4670	5 m
Bast	235	4900	12
Bamboo	209	4950	60 m
Bamboo	213	5010	22 m
Bast	195	5080	13 m
Bamboo	139	4030	9 m

Results over

TAE

A low resistance lamp with high economy lasts well.

A low resistance lamp with low economy shows some fault in cutting

The life of a lamp depends entirely on the weakest spot, and the lamp always breaks at the ~~one~~ spot~~s~~ which shows at low red the brightest.

The blue in a lamp depends on the highest

temperature of any part of the carbon and on internal area

THE

Lamp 1307 July 23. 1880

coarse ~~bast~~ bamboo

Good carbon
16 candles

6290
6290
6250
1500
20330
1011.6

Traces of blue

11-10 48 candles

6290
6290
6200
18780
939

11-32 blue disappeared

12- Engine stopped page 19

TAE

Estimate 6 inch lamps

July 28th 1880

10 candles 2700 ft lbs
1350
15 candles 4050

Practically 8 per H.P.

TAE

Lamp 1307 from page 15
coarse bamboo

	burned 50 minutes
1-57	Started 48 candles
2,15	Busted 68 Minutes

TAE

Lamp 1316
amaranth

very bad spot
did not go to
48 candles

TAE

Lamp 1304
Bamboo

Very good carbon

2-42 Started Reversed current

4-16 Went very rapidly

1.8
66
94 minutes

TAE

Globe darkened

[illegible]

[illegible] 240

[illegible] 13.2 per HP

M. 1308 Bamboo
Made from coarse fibre

Resistance Cold

6290
6250
6250
6290
6290
2100

YAE

Very even except towards one clamp dark

8 candles

6250
6290
6290
2100
(20930
104.6 Ohm
(2.30
76.6

No. 1308
Coarse Bamboo

16 candles

250 = ω

6250
6290
6290
2000
20830
104.15

THE

No. 1308

5-12	Reversed the current to Comp very fast
5-37 12 25	Stopped THE for motor
A.M. 9-30	Started 48 candles
954	24 25 49 minutes

No 1310

Jap bamboo

Very poor carbon

TAE

Lamp 1304 mid point good
Bamboo TAF

	Good carbon
1-45'	Started
	Heat fuse of magnet so as to do away with blue
2-35	broke

No 1239 V 113

Wound with wire

~~5400~~ ~~Ohms~~ TKS

~~5,4~~

~~147=~~ D

~~6290~~

~~6290~~

~~12058~~ Ohms

The blue could not be made to disappear. Tried magnet on carbon could by placing the globe in a certain position cause the blue to disappear entirely

1.55515
1.5515
1.6464
8.9031
3.6525 4500
4.5185

3
.8660 7.5 per H.P.

Lamp No 1323 July 24th 1880
Heated to white
in Kerosene

16 candles
107 = D
35.6

12.58 Ohms 7K5

67.5 inches
126 = D
4

6290
3800
10.090 Ohms

5-41

5-55 Took off current

4.0157
2.1945

1.8242
66. ft lbs

4416 1.6493
1.6493
1.6464
9.0737
4.0187

10.400

65.745 1.8145
1475 1.1688
.6457

19 1.2914
0.9031
156 candles 2.1945

No 1323

50
26 3/4
53 1/4 TAE.

Kerosene oil lamp
8 candles

9-37 65.1/4 inches

134
4416

6290
2150
8440.

7 49 5.
8
392 candles per H.P.

1.7267
1.7267
1.6464
9.1477
4.24425
17.500 ft. lbs
~~2.47~~

~~4.24425~~ 4.24425
~~3.1761~~ 2.5441
~~3.0664~~ 1.6984

50 ft. lbs per candle

No 1323 Thos A Edison
July 26 1880

9-48 Could not measure very easily but estimated 350 candles

7.2 Ohms

$\frac{160}{53.3}$ Volts.

10-1 Went at top of carbon 13 minutes

Bast No. 1324
Incandescent for a short time in oil TAE

Book 137 p 53

Resistance cold 135.4 Ohms

16 candles
86.9 Ohms
71.6 Volts

2620 ft. lbs.
12.5 per H.P.

No 1324 July 26. 1880

3.2	48 candles
	.6290
	6290
	3720
	16300
	81.5 ohms
	83.3 Volts
	8760 ft lbs.
	8.75 per H.P.
3.37	~~Went Char~~ stopped machine
	35 minutes

No 1324

4-53	Started
5-01	

HNE

2.0481
2.0481
1.6464
7.6747

3.4173
4.5165

1.1012

2600

12.6 per H.P.

No. 1 3 2.5
manilla fibre

July 26 – 1880

16 candles

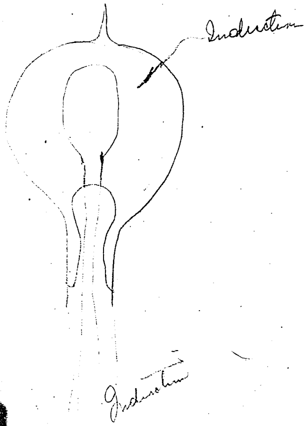
335 = Ω
111.6

6290
6290
6250
6250
6290
6290
4760

42360
211.6

broke at clamp

Thomas A. Edison



Lamps.

fixed with induction case.

16 candles
6290
6250
6250
6290
6290
4500
35870

179.35 Ohms

TAF

The vacuum gave —

273
272
54.5
amp 128.5
20
1.08

91.6 Volts

4430

1.08

2.7364
7.8911
1.3010
0.0334
1.9619
1.9619
1.6464
8.076
3.6464
.6018
.0346

Calor & Galva   July 27. 80

2-15 Temp air 83°3 F

1-48-3 70.9 F

94
70.9
23.1

273

12,580
4,200
16780
83.9 ohms

TAE

272
20 cells

64.5
64
128.5

2-53 89° F
2-57 94° F

4542
9494
48

1132
5
1137
247.5
8905
20
910

TAE

7.9599
0.3432
2.8893
9.0458
1.3636
3.6018
48
5970

23.1

4000

497	2.6964
Lamp 129.5	7.8877
~~Con~~ 20	1.3016
1.06	0.0253

9.2140

1.9104

8 \| volts 1.9104

1.6464

120.15 7.9205

3.3877

2440 ft. lbs.

4.5185

1.1308

13.5 per H.P.

Lamp No. 1327

New mould July 27.80

16 candles

247

250

497

18.830

5.300

241.30

120.15 Ohms

TAE

66 20 cells

63.5

129.5

2 7627
9.2140
1.9767
1.9767
1.16464
7.9568
3.5566

3600

3.600
4.5188
.9619

9.1 per H.P

Lamps No 1327

3-44 48 candles

291
288
579

18830
3300
22130
110.6 Ohms

TAE

4-51 Busted at 4.51
3.44
1.07

2.7752
9.2140

1.9892
1.9892
1.9892
1.16464
7.8962

3.5210

97.5 Volts.

3300

Lamp No 1328 July 28

New Mould

16 candles

25080
350

25430
127.15

296
300

596 Lamp

66.25
63.5 20 cells

12975

cracked in the glass around the clamps.

2.6866
9.2140
1.9600   79.5
1.9000
1.6464
8.0083
3.4547   2850
4.5155
1.0638

11.5 per H.P.

Lamp No 1322
Real Bamboo

16 candles

245
241
486

6250
6290
6290
800
19630
98.1 Ohms

TAE

2.7419
9.2140

1.9559
1.9557
1.8764
~~9~~.9017

3.4599   2880
3.5155

.0586

11.5 per H.P.

Lamp No. 1328
Good vacuum

16 candles

27.2

~~25080~~
1254

TAE

280
272

~~5~~.5 2

67.5
61.5

1290

2.8075
9.2140
2.0215
2.0215
1.6054
7.6459
3.3353
log 2 = 0.3010
3.6363 4330
4.5185
.8822

7.6 per H.P.

1-43 48 candles

18830
3770
22600
113

TAF

318
324
642

1.57 i. Went out.

150 2.1761
2.1761
1.3064
7.7258

3.7244
5300 Wrong

No 1337 July 29

6 inch length

16 candles

43 R
44 L
87

305
302
607

$\frac{37,660}{188}$ Ohms

685
115
59

.18357
.10607
.07750
2
1.55500

35.5
2
71

$\frac{66 \text{ candles}}{(80-x)^2} = 66$

$\left(\frac{80}{80-x}\right)^2 = 66$

$80^2 = 66(80-x)^2$

48
24
72

TAE

12 70 49
10 2
98

68 1.8325
12 1.0792
.7533
66 2
1.5066

39.5
2
79

69 1.8388
1.6414
7984
2
1.5966

534 2.7275
8.1870
1.08 0.0334
20 1.3010
2.2490
177 2.2490
1.6467
7.9696
3.9140

8200 Wrong

No 1337
16" long Bamboo

At 68.5 inches
6-48 Started

31370
2800
34170
170. ohms

265
269
534

35
30
65

TAE

Lamp 1337

6" Bamboo Drawn in sliding mould

6-18	Started 58.5 inches on bar or 71 candles
6-45	Blue disappeared
7-20	62 minutes

TAE

Standard cells
made July 30 1880

Lamp No. 1238
Bast clamped very light $V = 108$

16 candles
Bad spot

TAE

1,8976
1,8976
1,8464
8.0048

3.4464
4,5185

1.0721

2600

11.8 per H.P.

~~Lamp No. 329~~ July 30
~~New mould Bamboo~~

~~Oldenbau~~ No 1322
~~[illegible]~~
Real Bamboo 16 candles

238
235

79

63.5
66

18830
950

19780
98.9

TAE

1.9206
1.9206
1.6464
8.9018

3.4894 3080
9.5185

1.0291

107

Lamps 1331
Moss mould Bamboo

$\frac{250}{83.3} = D$

18830
1100

19930
99.6

1.9605
1.9605
1.6464
7.9814
3.5488

3540

Lamp No. 1332

went at clamp

Lamp No. 1336
vacuum gone

Lamp No 1333
18,830
2.050
20 8 80
10 4.4

127
91.3

TAE

Lamp No 132

Regular

TA

6.69
~~2.16~~

0.8254
1.3345

144 Volts 2.1599
2.1599
1.6464
7.6183

3.5845
3800 4.5185

.9340

8.5 per H.P.

Ino July 30, 1880

6" carbon

333 .16 candles
336

669

376.60
105.00

481.60
240.8 Ohms

49.25
50.75

100.00

Lamp in Kerosene vapor

2 candles

185 = D

~~4850~~

4500

22.5 Ohms Wrong

TAE

1.8573
1.8573
1.6464
8.7570

4.1180

13000

About 16 candles

$\frac{215}{72.5}$

$\frac{3500}{17.5}$

Wrong

TAE

2.4757
8.0875
0.0334
1.2015

1.8976
1.8976
1.6464
8.0342

3.4758 2999 ft. lbs.

The lamps in the calorimeter covered partially with shellac

Temp H_2O 69°.37
air 84°
14.7
68.3

4-30

1-45 Started

300 299
298 299

8 Till 82.75
82.5

12500
5900

18400
92.4

100
69.3
30.7

2 - 2

Stopped. 100° F

Total Wt Vessel

1102 Grms.
247.5
954.5
20

974.5 $\bar{1}$.9888
0.3432
2.8893
curt $\frac{\pi k^2}{l}$ 8.7696
1.9909
1.4871
2.4780

3000 ft lbs.

Paper in Kerosene

16 candles

5700
2800 Pens

148 = [illegible]

TAE

1.9460
1.9460
1.6464
5.0438

3.5822   3820
4.5185

.9363

.8.6 per Horse power

6" carbon in Gasoline vapor

16 candles Broadside
12550   19 candles 45°
.5600
18180
90.4

1265
88.3

TAE

1.8976
1.8976
1.6464
8.0031

3.4447   2780.

437 =
79

18.830
1.040

19.870
99.35

TAF

1.9805
1.9805
1.6464
7.9848
3.5922
4.5185
.9263

3910

8.44 per H.P.

Lamp No. 1343 Aug 2.80
6" Bamboo heated in gasoline

Resistance cold

18830
7300
26130
130.15 Ohms

287
287

64.5
65
95.6

18830
1900
20730
103.6 Ohms

1.8727
1.8777
1.6464
8.0264
3.4182

1.8633
1.8633
1.6464
8.0245
3.3975

2500

2620

	Volts	Ohms	H. lbs
page 78	79	98.9	2800
100	~~79~~	99.35	2780
104	73	94.5	2500
	74.6	94.1	2620

Lamp No. 1322

6" Bamboo in gasoline August 2

16 candles

219

218

73

18830
100
18915
94.5

224
74.6

18830
94.15

TAE

Aug 2

Lamp No 1343

6" Bamboo in gasoline

Very bad: spot below which has increased since the lamp was tried a short time since; blue on clamps

292

$$\begin{array}{r} 18830 \\ 1850 \\ \hline 20780 \\ 1039 \end{array}$$

Lamps no Aug 2

paper in kerosene vapor

---

16 candles

139 = Δ

$$\frac{5390}{26.9}$$ Ohms

TAE

11-3 68".5 Started

350

12 580
6 340
18 920
94.6 Ohms

11-7 Went TAE

Aug 2, 1880

2-4 Temp air 87°.87

2-20 71° F Temp water

268 = 0

18830
800
19630
98.15

Lamp. test

2.77
118.5

2.11425
7.92641
0.0334
1.3010 .92608

56.5
49.6

1.7033
1.6981
1.6466
8.5918

.4360

3.6394
3.6263
0.0133

1.03%

Calor Galva

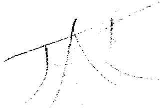
Lamp No 1342

Paper brought up in kerosene

2-36 Temp H_2O 74°.7 7

87.3
74.7
12.6
87.3
99°.9 7

5120
25.6



150 65 99.7
148 65 74.7
25.0

Machine	Batteries
277	120
277	117

2-45 Stopped 99°.7

Calor of Gabra

Wt vessel &c

1119
.247.5

871.5 T.D.C.
20

0.891.5 $\bar{1}$.9501
0.3432
2.8893
comp 9 9.0458
1.3779
4230 3.6263

2.4472
9.2608
1.7080
1.7080
1.6464
8.5935
4500 3.8559
3.6368
.0191 1.045 %

1152
245
907
20
927

T.9671
0.3432
2.8893
8.9586
1.4786
3.6368

1023
72.2
30.1

Calor Galva

3-4 72°.2 F Started

87.7
72.2
15.3
87.5
102.8

TAF

20 cells
12.1
117

280
280

15100
25.5

3-15 102°.3 F Stopped

1152 Grammes

278.5

2.4448
9.2608
1.7056
1.7056
1.6464
8.5910
3.6486
.6373
.0113

4450

1124
245
879
20
899

7.9538
0.3432
2.8893
9.0223
1.4287
3.6373

9.5
26.8

Galv 1,025 % greater than Calor

Lamp outside coated with tar

2.54

74° F

78) 4600000 (40
312
1480

4600000

873
74
133
873
1006

TAE

280
277
5130
25.65 Ohms.

2h - 53' - 30" 100°.8 F

100.8
74
26.8

1124

2.8092
7.8901
1.3345
2.0338

2.0338
1.6464
7.8172
3.5312
4.5185
.9873

3400

9.7

6" Bamboo

No, 1346

16 candles

25080
6100
31180
155.9 Ohms

TAE

325
320

322
322.5
5445

63
65.75
128.75

2.8000
7.9914
1.3345 9.3259
2.1259 133
2.1259
1.6464
7.8573
3.7555 57 ao
4.5185
.7630 3.8 per H.P.

3.7555
71 1.8513
1.9042 80 ft lbs per min

.7630
1.8513
2.6143 412

6" Bamboo Aug. 2

No. 1346

8-15 | 68".5 on bar

318 .53
3.4 49
3.7 102
631

25080
2710
27790
138.9

8-22 Stopped

8-24 Started

TAE

~~9-17 Edison~~
~~9-25 Batch~~
9-30 Hughes
~~9-10 Upton~~
~~9-18 Böhm~~
~~9-16 Martin~~

Pool closed

Pool closed

Bate ~~bets~~ ~~$1.00~~ $1.00 ~~that~~ Hughes
does ~~not~~ not win
with Hughes
Hughes bets that Batch
~~Be~~ does not not win 50cts
Batch bets $.50 that
does not last until 9-3
taken by Hughes

~~Edison bets $2.00~~
~~that lamp does not~~
~~last until 9-45 P.M.~~
with Hughes

Martin took 50 cts for his chance

~~Upton 9.45~~
~~Batch 9.50~~
~~Hughes 10-15~~
~~Edison 10~~
~~Martin 10-20~~
~~Hughes 10-25~~

Pool closed

Pool closed

Batch bets $1.05 that
Hughes does not win
Hughes bets $2 to $1 that
it last until 10.30
Batchelor

Hughes bets $3.00 to $2.00 that the Camp lasts beyond 10-30

~~[illegible]~~
Hughes 11-15
~~Watson [illegible]~~
Batch 10-45
~~[illegible]~~
11-30
11-45
~~[illegible]~~
Hughes 12-
Batch 12-15

close [illegible]

Hughes 12-30
Batch 12-45
1-
Hughes 1-15 $3.50

~~See~~

Batch ~~5.00~~ bets ~~that~~ $1.00 to 5.00 that the Camp won't last until 3 A.M tomorrow morn
open to 12

Hughes ~~bets that~~ $1.10 even that the Camp lasts until 2 A.M. - Patson Upton

Hughes bets $1.00 that Batch does not win the pot and that he wins

Hughes bet $10 that the Camp will ~~cast~~ cast until 2

Upton bets ~~$10~~ to $1.00 that it will not cast until 3. A. M

Taken Hughes

~~3h 40'~~

11h 40'-30 Went

Lasted

3h 28'

~~169~~

208 minutes

9.3259
2.4393
1.7652
0.3010
2.0662 116 volts
2.0622
1.6064
7.7922
3.5670 3690
4.5185
9515 8.9 per H.P.

Lamp No 1345 Aug 2 1880

6" Bamboo

16 candles

1275

25080
7200
~~1300~~
32280
161.4 Ohms

6r,5

330

2.4290
.3010
9.3259
2.0559
2.0559
1.6000
7.8111
3.5693

3710

16 candles

3400 ft. lbs
3690
8?.0

4.5185
3 5693
9492

8.9 per H.P.

Lamp No 1348

6" Bamboo

16 candles

263

25080
5810
30890
154.45

K

2.5250
0.3010
9.3739
2.1519
2.1519
1.6454
.7.8636
3.3738

141 Volts

6510

4.5185
3.8138
.7047

5 per H. P.

Aug 2. 1880

12-10

68.5

335=0
25000
2310
27390
136.9

Kol

$1.00

Batch bets that it
will not last until
1-40 A.M. Taken Hughes.
Same with Upton
Batch & Hughes repeat
above bet,

1st Pool, on Lane's 13 & 8

Upton 1

~~Batch 1-15~~ closed

Hughes 1-2.0

~~Batch 1-2.5~~

2d Pool,

1 Batch

1 30 Upton

2 Hughes

Hughes won.

1-47 Went

1-37

17 minutes

~~3,3,040,000~~

1100

~~20~~

12,000

12

3.14

~~14~~ 3.000

30

2.8062
8.0292
1.3139
2.1493

141 Volts.

August 3. 80

Machine on pumps

315 = D
325
640

49
44.5
93.5

TAE

141 Volts on line

318
318
320

290 2,4624
47 8.3279
1,334 5

133 Volts 2:1248
2.1248
1.6464
7.8359

5400 3.7319

133 : 147 :: 1459

2.1492
2.1671
7.8761

2.1894

15480 ohm
1459

8.6

6" Bamboo see page 132

No 1345

66.5 1,8228
13.5 1.1303

.6925
~~30100~~
1.3850
.3010

48.5 candles 1.6860

6" Bamboo

44 candles

290 = D 47
292 47
288
288

25080 1/2 hour
4100

29180

1459

Aug 3d

68'' 1.8325
12'' 10792

7533
2

1.5066
.3010

~~[illegible]~~ 1.8066

64 candles Put on pump line
at 3-55 P.M. clock
up stairs

Ran 2 hours 15 minutes
Engine ran too fast and
brake it.

2.6758
8.0254
1.3345
2.0357
2.0357
1.6464
7.8487
3.5666

93599
108
3600

Lamp No 134 Aug 3 1880
6" Bamboo FRu.

Good carbon
16 candles

237
23
47

46.3
48
943

TAE

25080
3220
28.300
141.5 Ohms

271 | 320 :: 134.5

2.1286
2.5051
7.5670
2.2607

158.7
134.5
24.2

16

543

2.7348
9.3599
2.0947
2.0947
1.6464
7.8714
3.7072

5400

Lamp No. 1346
6" Bamboo

68" 48 candles

271
272
543

25080
1820
26900
134.5

Went 20 minutes in
Photo room then up stairs

26848
9.3599
2.0447
2.0447
1.6464
7.8242
3.5600 — 3630
4.5185
.9585 — 9.1 per H.P.

Lamp No. 1349 Aug 3 1st Lam

Aug 3, 80

6" Bamboo

16 candles
Good lamp

242
242
484
25080
3,00
28180
140.9

283 : 320 :: 131.4 :

2.1185
2.5051
7.5482
2.1718

148.5
131.4
17.1

2.7520
9.3599
2.1119
2.1119
1.6464
7.8815
3.7517

129
129

5640

Lamp No 1349

48 candles

283
~~282~~
565

5-P.M. 25080
1200
26280
131.4

2.7292
8.0245
1.3345
2.0882 122

2.0882
1.6464
7.7253
3.5481 3530

Lamp No 1351

6" Bamboo.

Selected.

16 candles

268
268
536

46
48.5
94 5.

31370
6200
37570
187.8 Ohms

48 candles

31.370
3000
34370
171.85

No 1347

6" Bamboo Bad spot

~~Of~~ 8 candles

went in about five minutes

TAE

97
62
208
1367
...

510
197
420
360
1487
392

	Page	Ohms	Ft lbs			Ohms	Ft lbs	
	132	161.4	3690					
	136	154.4	3710			136.9	6510	Lasted 97 minutes

6" Bamboo Summary

		16 candles		48 candles		71 candles		
	Page	Ohms	Ft lbs	Ohms	Ft lbs	Ohms	Ft lbs	
	69	188				170		Lasted 62 minutes
	87	240.8	3800					
Good	123	155.9	3400			138.9	5700	Lasted 208 minutes
Good	153	140.9	3630	131.4	5640			
	157	187.8	3530	1748				about 5 minutes
1352	665	151.4	3660		p.175 5140			
	175	152.6	3500		p.180 4720	4720		Lasted 510 minutes
	184	137.2	3560	126.7	5400			Lasted glass 12 minutes
	188	151.5	3640	1399	5550			197 minutes
Poor	192	181	3620	161.3	6000			few minutes
	204	178.1	3610	161.6	5150			four minutes
	208	156.8?	4100?					Very ... bent carbon
		166.9	3370	158.7	4890			420 minutes
	220	216.6	3220	195.6	5180			Touched the glass
Poor carbon	224	233.1	3440					
			4560					

over

TAE

2.6902
8.0241
1.3345 9.3586
2.0488 114 Volts
2.0488
1.6464
7.8199
3.5639 3660

From page 163

	16 candles		48 candles		
1371 p. 228	165.9	3790	151.9	5430	
1373 p 232	166.3	3760	149.9	5380	Good lamp 360 minutes
1373 p 236	158.6	3650			
1374 p. 234	164.1	3670	156.1	504.0	
1376 p 244	238	3600			

Lamp No 13~~5~~2

Selected 6" Bamboo

16 candles

246
244
490

46.5
48.1
~~9~~4.6

25080
5200
30280
151.4 Ohms

TAE

Average at 16 165 Ohms
[illegible] out very high and [illegible]

Average Ft. lbs.
3580 for 16 candles

2.5185
4.3586
1.8771
1.8771
1.6464
7.7699
3.1705

75 Volts

1480

Lamps No 1552 Aug 3 1880 TKH.

6" Selected Bamboo [illegible]
0.012 X 0.012

1 Candle

165 R
165 L
330

TAE

8900
25080
33980
169.9

2.5587
9.3586

1.9173 82.6 Volts
1.9173
1.6464
7.7802

3.2612 1820

4.5185
3.2612

1.2573 18.1 per H.P.

6" [illegible] ~~Bamboo~~ GPM.

2 Candles

182 L
180 R

362

TAE

25080
8100

33180

165.9

2.6021
9.3586
1.9607
1.9607
1.9607
1.6464
7.7908
3.3586

91.3

2280

4 Candles

200 R
200 L
400

TAE

25080
7300
32380
161.9

2.6435
9.3586
2.0021
2.0021
1.6464
7.8065
3.4571

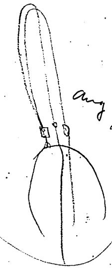
100 Volts

2865

Ho

$81 : 110 :: 6$

$81)\,660\,(81$
648
120



Aug 16 1880
ZKu

No 1852 Aug 3 80

8 candles

220 10
220 Ω
440

TAE

25080
6250
31330
156.65

2.6821
9.3586
2.0407   110
2.0407
1.6464
7.8164
3.5742   3500

It takes a ~~8~~ ft. lbs to give 2 candles
" b " " " " 12 candles
with same surface and curve
Surface = m gives 2 candles
Surface of another lamp = n
to give 12 candles what ft. lbs
required

No 1352 — Aug 3d 1880

About
9-P.M.   16 candles

240 L   45.5
242 R   49
240   94.5
481

TAE

25086
0350
30430
1526

2.7308
9.3586

2.0894
2.0894
1.6464
7.8404

3.6656 4630

13.3-2 [illegible] 3.00

32 [illegible]
Probably wrong

269 G
2

538

TAE

3800
35080

28860
144.4

2.7482
9.3586
2.1068
2.1068
1.6464
7.8511
3.7111   5140

2.7364
9.3586
2.0950
2.0950
1.6464
7.8621
3.6985   5000

67   1.8261
13   1.1139
.7122
2
1.4244
.3010
1.7254

3 candles

48 Candles

280
560

3100
25080
28180
140.9

9.26

TAE

9-30 67" on bar
275   274
270
545
25080
2400
27480
1374

50
44.5
94.5

2.7259
8.0223
1.3345

2.5827
2.6927
1.6464
7.8621

3.6739

9.3568

121

4720 ft. lbs.

866	2.9370
321	2.5065
562	2.7497
744	2.8716

11.0648
5.5324

116,100,000,000

340,800

No 1835 2

aug 4 8 A

8:45 A.M.

66".5 on bar

262
270
532

47.5
47.5
95.0

25080
2400
27480
137.4

TAE

The bad places in the carbon have increased since first last evening

25080
2350
27430
137.15

265
268
533

5
2
7

At 6 P.M. 8 hours 15 minutes
went 15 minutes more

8 hours 30 minutes
480
516

Pump line
Aug 4

315
318
633

533 : 633 :: 137.15 :

2.8014
2.1372
7.2733
2.2119

TAE

163
137.15
2585

12 feet 24.5 Ohms

Lamp 1352 feet in
pump line at 48 candles
with 1 hour 15 minutes
Time

9.3568
26646
2.0214 105
2.0214
1.6604
7.8627
3.5519 3550

Lamp No 1355
6" Selected Bamboo

Very good carbon
16 candles

TAE

25.080
2370
27450
137.25

234
228
462

531 : 633 :: 126.7

2.7028
2.8014
7.2749
2.1791

151
126.7
243

2.7251
9.3568
2.0819
2.0819
1.6464
7.8972
3.7074

5400

48 candles

TAF

264
262
268
531

25080
270
25350
126.7

Went in 12 minute in the glass

2.6902
9.3568
2.6470
2.0470
1.6464
7.8210
3.5614   3640

No 1354

6" Selected bamboo   0".012 X 0".012

Very good carbon
16 candles

248
242
490

TAE

25080
5220
303 00.
151.5

580 : 633 :: 139.9 :

2.8014
2.1458
7.2366
2.1838

152.5
139.9
12.6

580 2.7634
9.3568
2.1202
.02
1.6464
7.8542
3.7410

5550.

No 1354

48 candles

TAE

287
293
580
25080.
2900
29980
139.9

46.
49.
95

(20 cells

11.38
22
7.55
3 hr 17 minutes

197 minutes

535 2.7284
9.3568

2.0852
2,0852
1.6464
7.7416

3.5584 3620

No. 1353

6" Selected bamboo

Irregular at low red dark places in middle of side

16 candles

TAE

265
270

535

.31370
4900

36270
181.35

2,8129
9.3568
2.1697
2,1169
1,6464
7.7925
3.7783

6000

48 candle
Blue at clamp.

3.20
3.30
.50

TAE

31370
900
32270
161-35

Went in few minutes

4600 000
78
36800 000
322 00000
358800000

78 / 4600 000 (58
390
700
7 4

7

78.

460

88 / 4600 000 (4
342

1

1.800 000 / 2660 000
18
8
2

69

Aug 4 1880 1-30 P.M.

Pump Line

300
307

48.5
45.5
940

Put in one plug in magnet line

313
317
630
31.6
31.4

TAE

2.4997
8.0269
1.3345

1.8611
1.8611
1.6464
7.9700

3.3386
0.8451
.4935

9.3614
72.6 Volts

2180

311

Lamp No. 1339

7 candles
156 L
160 R
316

94

18830
2600
21430
1071

TAE

Lamp No. 1331

6 3/4 candles

156
157

18830
1470
20300

TAE

No. 145~~6~~

Direct on pump line

~~48 smaller~~

69
11

1457
65.75

page 208

	2.10807
	2.10807
	~~7.16464~~
	7.7494
3610	3.5572

Lamp No. 1366

6" Bamboo from gas furnace

16 candles

262
262
524

47.5
48.
95.5

31370
4250
35620
178.1

TAE

603 ; 633 ; ; 161.6 ;

2.2088
2.8014
7.2197
2.2297

169.7
161.6
8.1 4 ft.

603

2.7803
9.3568
2.1371
2.1371
1.6464
7.7717
3.7123

5150

Lamps No 1366
6" Bamboo

8-30 48 candles.

303
300
603.

31370
950
32320
161.6 Ohms

Lasted four minutes

AE

9.3614
2.7193
2.0807
2.0807
1.6464
7.8047
3.6125
4.5185
9060

4100

8.05 per H.P

No. 1367

6" Bamboo

16 candles

262
262
524

31370
156.8 Ohms

95.5

Probably wrong TAE

12

8

10.5 candles for 250 ft lb

16
1500
250
4000
8
32000

1

12

116
5.66
10 1/3

3030
1515
4545

4.5185
.6571
8614

7.3 per H.P.

16
8
128

4.5185
2.1072
2.4113

257 ft. lbs per candle

2750 3.4393
12 1.0792
2.3601
229

~~2825 3.4509~~
~~13 1.1139~~
~~2.3370~~

~~267~~

2625 3.4191
10.5 1.0212
2.3979

250
29
14.75
2950

2950 3.4968
9.5 0.9777
47 5191
2

90 1.9542
1.6 0.2041
56 hours 1.7501 1 ct

2000
1000

11
16. 1.2041
8. 0.9031 1 ct
7.5. 0.8751
2.9823
1.0414
$\bar{2}$.0591

.0114 Gallon

$\frac{1}{90}$ gallon per hour

220 1.3424
$\bar{2}$.0591
$\bar{1}$.4015
.2041
.252 $\bar{1}$.6056

.4 1/4 ct per hour
for 10 candles.

Kerosene oil lamp

22. fluid oz of
[illegible]osene in lamp.

Started 10-3 by
my watch

10-10 8 candles TAE
1-37 11 candles
5-25 9 candles
5.-40 Put out and
11 oz left
7.5 hours

4-7

2.6964
9.3568
2.0522
2.0522
1.6464
7.7776
3.5284

3370

Lamp No 1367 6" Bamboo

a slight spot on one side but a very good carbon Bent over nearly touching the glass

16 candles

252
245
497

52
47.5
94.5

51
43.5
7.5

25080
8300
33380
16690

Hung (Lamp.

Saddle

582; 630 :: 158.7;

2.1992
2.7993
7.2351
2.2336

171.2
158.7
125 6'1"

2.7649
9.3568.
2.1217
2.1217
1.6464
7.7995
3.6893 4890

1367

48 candles

295
287
582

25080
6670
31750
158.7

On pump line
7 hours
60
420 minutes

Lamp No 1368
6" Bamboo

Very bad spots N.G.

TAE

2.7419
9.3568
2.0987
2.0987
1.6464
7.6643
3.5081 3220

Lamp No 1369
6" Bamboo

16 candles

280
272
552

37660
5670
43330
216.6

TAE

2.8228
9.3568

2.1796
2.1796
1.6464
7.7087

3.7143   5180

48 candle

335
330

665

37660
1470

39130
1956

Touched the glass

2.7723
9.3568
2.1291
2.1291
1.6464
7.6324
3.5370

3440.

Lamp No. 1372

Wavy, light and dark
16 candles

292
300
592

37660
5970
46630
2331.5

2.7959
8.0246
1.3345
2.1550

9.3591

143 Volts

No 1372 22 candles

9-10 P.M. Put on Pump line

Deflection on pump line

310 R
315 L
625

Went in about two minutes with arc

JFO

2.7185
9.3591
2.0776
2.0776
1.6464
7.7772
3.5788 3790

This lamp placed so as give 48 candles. Melted of the German silver wire 4 ft. in with it. Clamps black and wire black. Put at sixteen candles blue at clamps. D = 285 after short time carbon gave arc at clamps cleaning them and depositing carbon on the tip of the clamp removed from the break.

No. 1371

16 candles

259
264
523

25080
8100
33180
165.9

TAE

597 : 630 :: 151.9

2.1815
2.7993
7.2240
22048

160.0
151.9
8.1

2.7760
9.3591
2.1351
2.1351
1.6464
7.8185
3.7351

5430

No. 1371

48 samples,
see page 228

294
303
597

25080
5300
[illegible]
151.9

2.7160
9.3591
2.0751
2.0751
1.6464
7.7792
13.5758

3760 ft.

No 1373

5" Bamboo

Very perfect carbon a slight bad effect near clamps
~~Straight~~
16 candles

TAE

255
265
520

31,370
1900
33270
166.35

2.7709
9.3591
2.1300
2.1300
1.6464
7.8242
3.7306   5380

590 : 630 :: 149.9 :

2.1758
2.7993
7.2291
2.2042

160.0
149.9
10.1   5t

Over p. 236

No., 1373
6" Bamboo

48 candles
by mistake very high

300
290
590

25080
4900
29980
149.9

6 hours
360 minutes

TAE

2.6990
9.3591

2.0581
2.0581
1.6464
7.7997

3.5623 3650 ft lbs.

From p. 234

Blue all through lamp good lamp when put on pump line

Lamp No. 1373 Aug 5
6" Bamboo

16 candles again has been very high since last brought up

255
245

500

TAE

25080
6650

31730
158.6 Ohms

2.7076
9.3591

2.0667
2.0667
1.6464
7.7850

3.5648 3670

Lamp No 1374 Aug 5

6" Bamboo

Good straight carbon

16 candles

258
252

510

25080
7750

32830
16415

583 : 630 :: 156.1 :

2.1934
2.7993
7.2343
2.2270

168.8
156.1
12.7 6" 5"

2.7657
9.3591
2.1248
2.1248
1.6464
7.8067
3.7027 5040.

No 1374
6" Bamboo

46 candles

287
296
583

25080
6150
31230
156.1

Put on Pump line
8 minutes
Very bad spot in lamp

Lamp No 1376
6" Bamboo

Good straight carbon
16 candles over page 245

TAE

2.7839
9.3591
2.1430
2.1430
1.6464
7.6229
3.5553

3600 ft. lbs

Lamps 1376
6" Bamboo

~~48~~ 16 candles see p. 143

310
298
608

37660
[illegible]
[illegible]
2375[illegible] [illegible]

Burning four hours at —

2,8035
9.3591
2.1626
~~2.1626~~

145,5

Pump line; Aug. 6, 1880.

Say 630

318.
318
636

45
49.5
94.5

Lamp 1376 across the wires
27 candles TAE

313
317 oscillates slowly up and down

318
309
628

with 3 machine current

37660
7300
44960

Lamp No. 1375
6" Bamboo

Bad lamp very high
resistance blue at clamps

Hung direct across the
line.

TAE

Lamps No. 1378
6" Bamboo

Went in glass on bringing up.

TAE

Pump line

Aug. 6, 1880

3 P.M. 20 cells 49
45.5
94.5 = 0

300
296

Changed
311
308
3.9

313 TAE

Lamp No. 1379 Aug 6

6" Bamboo Taken from gas

Carbon wavy and uneven
48 candles

TAE

$$\frac{E^2}{R} \cdot 44.3 = \text{ft. lbs}$$

$$E^2 = \frac{\text{ft. lbs} \times R}{44.3}$$

3.6154
2.1761
8.3536

$\boxed{4.1451}$

2.0725

118 Volts

Aug 11 Wednesday eve

Mr. Edison wishes to start 200 lamps next Friday

Conductors.

The line leading along the turnpike to be wound with three layers of cloth tarred, then wound with marlain.

TAE

See that plenty of cloth and marlain are ordered and that men enough are put on the jobs.

seven days labor

cloth, ok
Marlain
Tar
Labor
rubber tape
Wires cut off

3 # machines

Present lamp requires 115 Volts
machine must run 1100
revs. The exciter must run
from main shaft.

3 machines probably enough
since the lamps are so much
higher resistance. TAE
must run 1100 revs.

The three machine in position
now will do the business if
changed to multiple arc
which can be done in a minute.

Rig meters for
2 for 20 lights Edison Jordan
1 for 30 lights Laboratory

Lamps
Glass must have ok
Blowers
Pumps arrangement for bringing up lamps while on.
Pick out lamps. class the lamp post and number lamps accordingly.
5 classes according to distance

Meter

The average E.M.F. is [illegible] Volts

$\frac{115}{165}$ Webers

1 mg. per hour

1/10 mg. per hour

Houses

In Mrs Jordans relay the the wire out of sight.

~~Seguidor~~
Herrick
Hammer
Force

[illegible]

TAE

Davis' Hotel Mrs.
Cornish's Kuesie Edisons

Wrap wire used twice in rubber. tape solder joints. use lead safety clutches.

67.75 1.8309
12.25 1.0881
7.28

56 candle

Lamp No. 1399 L

20 cells 46
40
86

48 candles TAE

~~290~~ 290 ~~300~~
290 ~~270~~

31370
2500
$\boxed{33870}$
169.35 Ohms

2.7731
8.0655
1.3345
2.1731 149 Volts

Pump line

300 - 310

305
288
593

300 304
280 285 - JAL

Lamp No 1399 C

48 candles

283
286

TAE

31370
6500
37870
189.35

Lamp No. 1416. High vacuum

6" Bamboo 0".012 X 0".012 first lamp from new mould to carbonising so as to place in the clamps sideways

Straight carbon

Slightly wavy and irregular

16 candles

TAE

213
208

31370
2900

$\boxed{34270}$

17135 Ohms

Lamp No 1416

48 candles

247
238

TAE

31370
800

Lamps No. 1419

bad spot

4-40 48 candles

20 cells

40 both ways

267 on lamp
270

31370

TAE

Lasted about 10 minutes

Lamp No. 1420

6" Bamboo

48 candles

11-20 253
251

40.5
41. 20 cells

25.080
5700

11-30 Stopped

Lamp No. 1421

6" Bamboo

48 candles

223
224

TAE

25080
2900
27980

7.5

$\boxed{1oz \ 1/2}$

3
2

.7559

~~1553~~
8.2441
2.7782
1.3345
2.3568 227 Volts

32 oz 1 ~~Gallon~~
4
128 oz 1 Gall
.43
.85 hours

42.5
3
127.5

230
235
465

27
30
57

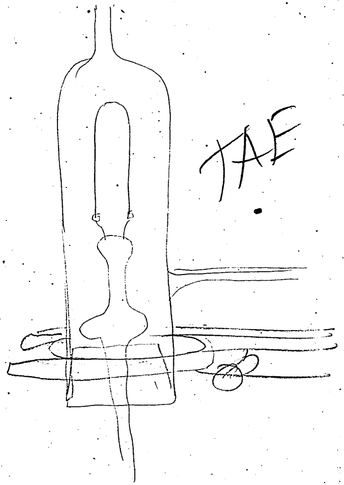
2.6675
8.2441
1.3345
2.2461

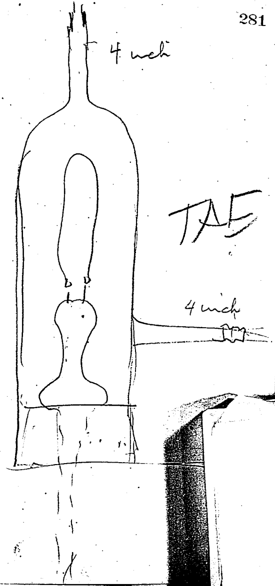
176 Volts

T 26 E
31
57

.4 mills for ten
.5 mills car hours

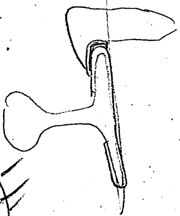
200
.4
80


TAE


4 inch
TAE
4 inch

150	2.1761
	2.1761
	1.6464
4.8	9.3188
	5.3174
207,000	4.5185
	.7989

6.2 H.P



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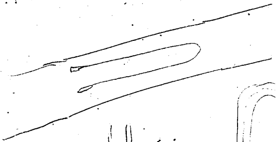
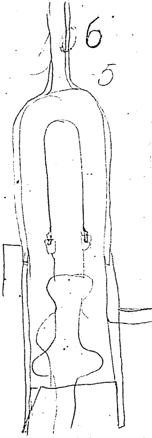
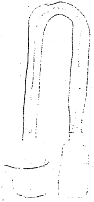






TAE

15 180
30
4500

70
4
280
10
1800

210
210
2100
420
14100
44
17040
17640
4) 1.94 0,4

105
105
525
~~105~~
105
12075
44
4830
48300
531300
3
1593900

THE

1.940
4.58
25

6.2878
0.6812
5.6066
4

404,000

28.

15
60

40
4
60
10
600

220) 9.6 ~~00~~ (1
4
72

40
1208

120
30
4
1200

1/4 1/4

28.hp

28.
3
84.

75

2,600,000
78
20800000
18200000
202800000

120.
12
240
1200
144

/200

4) 1.940,400
485,100

10.00
3

101

3000

48) 485100
121275

48) 485100 (101
48
50
48
200

48) 4851000 (1
48
5

THE

Menlo Park Notebook #113 [N-80-06-14]

This notebook covers the period June-August 1880. The name of George H. Hill appears on the cover. Hill's name and Edison's initials also appear on page one. There is no other indication of authorship. The book contains a record of tests on experimental lamps, numbers 1175 to 1505. The cover is labeled "Lamps on pump," "July 25, 1880," and "George H Hill." The book contains 284 numbered pages.

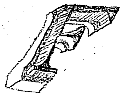
The following pages contain skeleton tables that were never filled in (not filmed): 8-25, 28-39, 48-49, 52-53, 154-177.

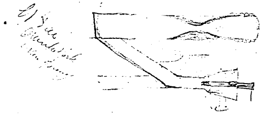
Blank pages not filmed: 178-281.

Book of Lamps
June 1175

FROM
WILLIAMS & PLUM,
Printers, Stationers
AND
Blank Book Manufacturers.
777 Broad St. NEWARK, N.J.

Cr of Lamp	Remarks
1175	there was a good many Lamps made that mo Keemer was killed Heer
1177	



No of Lamp	Remarks
1175	there was a good many Lamps made that no Record was kept of [illegible]
1176	
1177	[illegible]

start-950

13[illegible] m Broke at 954

1356 L Broke 10.20

1357 R Broke 10.30

1358 m start 957 to 11,37

1339 [illegible]tarted at [illegible] [illegible]

1331

Aug 4, P.m.

[illegible] at 11.[illegible] Broke

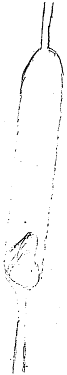
[illegible] minutes

1373 started at 11.35

13[illegible] started 11.45

13[illegible] start at 12.[illegible]

No of Lamps	Remarks
1178	
1179	
1180	



No Samp	Remarks
1181	
1182	
1183	

Start 130 stop 145
[illegible] spots in carbon

No Lamps	Remarks
1184	
1185	
1186	

No Lamp	Remarks
1214	
1215	
[illegible] 1216	~~[illegible]~~ Large Clamp Munkey grass [illegible] Spots in carbon Carbon split in one clamp after running for 25 minutes it gave a Bright light Volume 105 B

No Lamp	Remarks
July 26 1236	Bass fiber- Broke the carbon as soon as the current was put on did not give any light
1237	
July 26 1238	Bass fiber- there was Bad spots in the carbon very bright spot at the clamps did not give a good light V 105-
July 24 1239	Bass fiber Extra no spots it gave a good light Vacuum 118

No Lamp	Remarks
1240	
July 23 1241	Bass Fibers - Bad spots in carbon and did not give a good Light Vacum 110
1242	
July 27 1243	Large Bass fiber - White Wire through the Bulb and small Piece of Carbon on the end of Wire no spots gave a good Light When sealed off V108

No Lamp.	Remarks
1244	
July 27 1245	Bass Fibres - Broke as soon as current was put on
1246	
1247	

No Tamp	Remarks
1248	
~~[illegible]~~	~~[illegible]~~
1249	
1250	
1251	

No Lamp.	Remarks
1256	
July 26 1257	Bass Fiber - no spots it gave a good light Vacuum 110
July 27 1258	Bass Fiber - Regular Had spots in the carbon but it gave a good light - Vacuum when sealed off 105
1259	

No Lamp.	Remarks
1264	
1265	
1266	
June 15 1267	Bursted soon as put Current on did not get no Light the Carbon Went into fine Powder.

No Lamp	Remarks
June 15 1268	no spots 100 m m slightly Blue With high Current
June 14 1920 1269	Bass fiber dipped in solution of amonia no spots same Color as all the ammonia
June 15 1270	Bass fiber dipped in amonia same as 1269 no spots high Vacuum same color as all amonia
June 15 1271	high Vacuum no spots 100 m m.

No Lamp	Remarks
June 16 1880 1272	Bass fiber- carbonized in Exc P. 1- Recarbonized Platinum does not show very good on them gives it Platinum spark
June 16.1880 1273	Bamboo fiber- no spots high Res Vacuum 100 m m Both Ends split inside 
June 16 1880 1274	Good carbon no spots Slightly Blue 95 m m
June 16 1880 1275	Good carbon no spots Slightly Blue

No Lamp	Remarks
June 16 1880 1276	Bamboo with notch in one side very bad spots in it but not at the notch
July 17 1880 1277	Bamboo with notch cut in one side High vacuum 8 mm very good notch was very bright spot
1278	
July 17 1880 1279	gave a good light no spots from 1015 to 1150 am high vacuum sealed off.

No Lamp	Remarks
July 17 1880 1280	Paper-carbon Bad spots and Very crooked carbon sealed off with high Vacuum time 1.10.255-8m
1281	
July 17 1282	Bamboo Fiber- no spots Very high slightly Blue When full current was on
July 19 1283	Bamboo Fiber- Broke the carbon as soon as current was put on close to the clamp did not give any Light

No Lamp	Remarks
1284	
1285	Bamboo Fibers- no spots it gave a good light high Vacuum When sealed off V 107 July 19
1286	Bamboo fibes- it gave a Good light it had no Bad spots in it- V102 July 19, 1880.
1287	Bamboo fibes- no spots it gave a good light- Vacum 107 July 19. 80

No Lamp	Remarks 67
1288	Spot Light high Vacum Bass fiber dipped in syrup Vacuum 100
	July 19, 80
July 19 1289	Same as 1288 gave a good Light no spots Vacuum When sealed ## 103
July 20 1290	Bamboo fiber it Was Very Bright on one side of the Carbon and had spots in Vacum When Sealed ## 100
July 20 1291	Bass fiber With Plat on Ends of Carbon no spots it gave a good Light Vacuum 112

No. Lamp	Remarks
July 20 1292	Bass Fiber- several Bad spots in Carbon Bright spot in the centre of the Carbon and it did not give a very good light- Vacum 107
July 20 1293	
July 20 1294	Bamboo Fiber- no spots in carbon it was very even and gave a good light- after it burnt for about half an hour found out that the Carbon was split in the clamp-
July 21 1295	Bamboo Fiber- there was some Bad spots in carbon as marked here V.acum 105 

No Lamp	Remarks
July 21 1880 1296	Bamboo Fibers- no spots it gave a good Light- Vocum When sealed off 105.
1297	
July 21 1880 1298	Bamboo Fibers- there Was Several Bad spots in the Carbon Vocum When sealed off 105-
July 21 1880 1299	Bamboo Fibers- Very Even no spots gave a good Light- But Was slightly blue Vocum 104

No Lamp	Remarks
July 21 1920 1300	Bamboo Fiber- one side of the Carbon Was dark and the other side Light Red Vacum When sealed off 105
July 22 1301	Bamboo 12X12 Regular very Even no spots in the Carbon after it Burnt for about one hour - found out the carbon was split in in the clamp Vacum 112
July 22 1302	Bamboo 12X12 Regular sealed off there was a crack in the in side glass Could not get a Vacum sealed off the pump
July 22 1303	Bamboo Regular Very small spots in the Bottom of Carbon and gave a Bright Light on Bottom of Carbon V112

No Lamp	Remarks
July 22 1304	Bamboo Fiber- several Bad spots in the carbon but it gave a Bright Light- Slightly Blue Vocuum 114
1305	
1306	
July 23 1307	Bamboo fiber 12X12 no spots after it Burnt for about 25 minuts found the Carbon was split in the clamp it gave a Bright- Vocuum 114

No Lamp	Remarks
July 23 1308	Bamboo fiber - 12X12 no spots it gave a good Light - slightley Blue Vacuums 112
July 23 1309	Bamboo fiber - no spots Gave a good Light - But was slightley Blue Vacum 110.
July 22 1310.	Japanese Bamboo Fiber - Bad spot in carbon as marked here there was a split in Carbon in the Clamp it did not show the split untill it Burnt for about 25 minuts Vacum 112
July 27 1311	Real Bamboo Fiber - very Even no Bad spots in Carbon after. it Burnt for about one hour. found out that the Carbon was split in the Clamp V 112

No Lamp	Remarks
July 21 1312	Real Bamboo Fiber one side of the Carbon was a little darker than the other it Burnt for about one hour found out that the carbon was split in Clamp
July 22 1313	Japanese Bamboo fiber Broke as soon as Current was Put on did not give any Light
July 22 1314	Japanese Bamboo Fiber Broke the Carbon as soon the Current was put on did not give any Light high Vacum.
1315	

No Lamp	Remarks
July 23 1316	amaranth Wood The Carbon Was full of Bad spots and showed the Blue very Plain Vacuum 104
July 28 1317	ordinary Bamboo no spots gave a good Light Was slightley Blue Vacuum 112
July 24 1318	amaranth 12X12. Bad spots in the carbon showed the Blue Very Plain at the clamps sealed off With high Vacuum
July 24 1319	White Holly Bad spots in the Carbon and gave a Poor Light Vacuum 103

No Lamp	Remarks
July 24 1320	White Holly Bad spots in Carbon it showed Blue very Plain from the Clamps and Carbon
July 24 1321	TULIP. WOOD 12X12 Broke on the Pump By the mercury Running in the Lamp By G.H.
July 24 1322	Bamboo Fibes. no spots it gave a good Light it Was Slightly Blue Vacuum 112
July 24 1323	Bass fibes- arc formed in the Clamp But it gave a Bright Light

No Lamp	Remarks
July 26 1324	Bass Carbonized in Kerosene for instant only no spots it gave a good light showed Blue on the clamps Vacuum 105
July 26 1325	manilla fiber Treated in Kerosene Bad spots in the carbon give a Bright Light Vacuum 107
1326	treated in Kerosene soon as current was put on it broke the carbon at the clamps
July 27 1327	made in even mould Regular no spots very even gave a good light after it burned for about 30 minutes found out the carbon was split on clamps V 110

1331 Started [illegible] at [illegible] 2 [illegible] Pm

No Lamp	Remarks
July 27 1328	Made in new mould 12X12 Same as 1327 no spots it gave a good light V112
July 28	1328 Put on second time no spots it gave a good light Vacuum 112
July 27 1329	no spots it gave a good light very high current Vacuum When sealed off 110
1330	
July 1331	Bamboo Bad spots in carbon it gave a Bright Light with high current Vacuum 110

No Lamp.	Remarks
July 28 1332	Bamboo Bad Spots in the carbon close to the clamp Vacuum 110
July [illegible] 1333	Bamboo Bad Spots in the carbon and bright spot at the clamp it gave a very Bright Light. Vacuum when sealed 1.08
1334	
July 27 1335	Bamboo Regular 12X12 no spots it gave a good light after it Burnt for a half an hour found out the carbon was split in the clamp Vacuum 110

1339 Started to Burn
5 minuets Past 2 aug 4 Pm

No Lamp	Remarks
July 30 1336	Bamboo Reg 12X12 With. Car on Ends of Carbon no spots it [illegible] good Light - Vacuum [illegible] 110
July [illegible] 1337	Large 6 in fiber - no [illegible] it gave a good Light after it Burnt for about 25 minuets found out the Carbon was Split in clamp V 100
July 1338	Large 6 in fiber - no spots as soon as the Current was put on Saw the carbon was split in the clamp it gave a Bright Light Vacuum 110
Aug 2 1339	Bass fiber - Bad spots in the Carbon But it gave a good Light . Vacuum 95

No Lamp	Remarks
Aug 2 1340	Bass fiber - Same as 1339 Bad spots in Carbon it gave a good Light was slightly Blue Vacuum 99
July 31 1341	Bamboo 12 X 12 Large fiber Bad spots in the Carbon. Vacum 95
July 31 1342	Paper-Carbon no spots gave a good Light Vacum 107
July 30 1343	Large fiber no spots gave a good Light Vacuum 100

No. Lamp	Remarks
Aug 2 1344	Large fiber- no spots it gave a good Light Slightly Blue Vacuum 105
Aug 2 1345	Large fiber- no Spots gave a good Light- Slightly Blue Vacuum When Sealed off 105
Aug 2 1346	Large fiber- no spots gave a good Light was Slightly Blue Vacuum when Sealed off 105
Aug 3 1347	Large fiber Bad spots in the carbon but it gave a Bright Light and was Slightly Blue Vacuum 107

No Lamp	Remark
Aug 2 1348	Large Fiber- no spots it gave a good Light is slighty Blue Vacuum 110
Aug 3 1349	Large fiber- no spots it gave a good Light slighty Blue Vocuum 105
Aug 3 1350	Large Fiber- no spots it gave a good Light after it burnt for about one hour found out the Carbon has split in the Clamp slighty Blue V105
Aug 3 1351	Large fiber no spots it gave a good Light Vocuum 105

No Lamp	Remarks
Aug 3 1352	Large Fibers - no spots it gave a bright light - was slightly Blue Vacuum 107
Aug 3 1353	Large fiber - no spots gave a good light - was slightly Blue Vacuum 105
Aug 3 1354	Large fibers - no spots it gave a good light was slightly Blue [illegible] 110
Aug 4 1355	Large fiber - no spots after it burnt for a few minutes found out the Carbon was split in the lamp it gave a good light Vacuum 10[illegible]

Started 950 Broke 10.20

13 Started to Burn at 950
Broke 10.80

~~1358 Start [illegible] 945~~
~~Broke at 10.30~~ Started to
Burn 957, Broke 11.87

No Lamp	Remarks
Aug 4 1356	Large fiber no spots [illegible] gave [illegible] light [illegible] was bent very bad Vacuum when [illegible]
Aug 4 1357	Large fiber [illegible] it [illegible] light carbon [illegible] shape Vacuum 100
Aug 4 1358	Large fiber [illegible] it [illegible] V[illegible]
Aug 4 1359	Large fiber Bad spots But it gave a good light Vacuum 98

No Lamps	Remarks
Aug 5th 1360	Large Bamboo fiber. no spots [illegible] in the lamp Vacuum 95
Aug [illegible] 1361	Large fiber Bad spots in carbon gave a Bright Light - Sealed off With high
Aug 7th 1362	Large fiber.
1363	

1366 Started at Bur 750
Broke at [illegible]

1367 Started at 12.5 Aug 6
Broke 750. Pan

No Lamp	Remarks
1364	
1365	
Aug 4 1366	Large Bamboo fiber Bad spot in Carbon Carbon was split in the Clamp gave a good [illegible] Vacuum 100
Aug 6 1367	Large Bamboo fiber no spots it gave a good Light Vacuum 100

No Lamp	Remark
Aug 4 1368	Large Bamboo fibres- Bad spots in carbon split in clamps But gave a good light Vacuum 98
Aug 5 1369	Large Bamboo fibre- Bad spots in the carbon gave a good light Vacuum 104
Aug 5 1370	Large Bamboo fibre full of bad spots and gave a poor light Taken off without exhausting.
Aug 5 1371	Large Bamboo fibres- no spots gave a good light Vacuum 100

1373 [illegible] the Burn
[illegible] Broke 5.15

1374 [illegible] Burn
11.13 ~~[illegible]~~ Burnt [illegible] minuts

1375 [illegible] 11.45 am

No Lamp	Remarks
Aug 5 1372	Large fiber - no spots it gave a good light - Vacuum 100
Aug 1373	Large fiber - no spots it gave a good light. Vacuum 100
Aug 5 1374	Large fiber no spots gave a good light - Vacuum 100
Aug 5 1375	Large Bamboo fiber Bad spots in the Carbon Split in the clamp

Ca...
Broke 935

No Lamp.	Remarks
Aug 5 1376	[illegible] [illegible] no spots Carbon split in [illegible] Clear [illegible] [illegible] [illegible] Light Vacuum [illegible]
Aug 5 1377	Large fiber - Experimental X Bad spots on Carbon But it gave a bright light slightly blue
Aug 5 1378	Large fiber - Experimental no spots It gave a good light secure [illegible] with high Vacuum
Aug 5 1379	Large fiber - no spots gave a good light high Vacuum on Pump

No Lamp	Remarks
Aug 6 1380	Large fiber No spots gave a good light broke off in the neck. Vacuum New pump
Aug 6 1381	Large fiber Bad spots after turned for a few minutes developed one small spot on side of carbon did not show when lamp was made. Taken off without testing
Aug 6.5 1382	Large fiber no spots it gave a good light and was standing fine. high Vacuum New Pump
Aug 7 1383	Large fiber no spots it gave a good light was split in the clamp high Vacuum

No. Lamp	Remarks
Aug 1384	Large fiber no spots [illegible] in the lamp
Aug 1385	Large fiber no spots gave a good light it was [illegible] Vacuum 105
Aug 1386	Large fiber no spots gave a good light high Vacuum 105
Aug 6 1387	Large fiber no spots Broke in the pump with a high Vacuum

Aug 6

1888 no spots Carbon Was split in clamp sealed off high Vacuum

1888 Was missed When [illegible]

1392 Large fiber - Run out pump second time

No Lamp	Remarks
Aug 6 1389	no spots the Carbon Was split in the clamp sealed off high Vacuum
Aug 1390	13[illegible] no spots Broke By Letting the mercury Run out of the pump
Aug 6 1391	Large fiber Bad spots did not give a good Light
Aug 6 1392	Large fiber no spots split in Clamp could not get a high Vacuum glass [illegible] off the inside [illegible] at Wire

No Lamp	Remarks
Aug 7 1393	Large Film
Aug 7 1394	Large film. Bad spots gave a [illegible] high vacuum
Aug 7 1395	Large film no spots gave a [illegible]
Aug 1396	Large film. no spots Cracked in the [illegible] in clamp - gave a [illegible] high vacuum

1400 A Bad spots in Carbon after it burnt for about half an hour. the Carbon split apart in the Clamp and broke noted off

1399 C no spots gave a good light - split in Clamp high Vacuum

1399 B no spots gave a good light high Vacuum

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1400 ~~No 5~~ C Large fiber -

~~1400 A Bad spots in carbon cracked in clamp broke on pump~~

No Lamp	Remarks
1397	Large fiber -
Aug 7 1398	Large fiber - no spots gave a good light high Vacuum
Aug 11 1399	A Large fiber - no spots gave a good light did not get a high Vacuum by order of TAE.
Aug 11 1400	B. Large fiber - no spots gave a good light did not get a high Vacuum by order TAE

1402 Large fibers - B
Bad connection in the lamp could not get any light

No Lamp	Remarks
Aug 12 1401	Large fiber - Bad spots But it gave a good light did not get a high vacuum By order - TAE
Aug 12 1402	Large fiber - ~~Bad~~ spots did not give a good light Bent out of shape LOW. VACUUM By order TAE
1403	
1404	

No Lamp	Remarks
1405	
Aug 12 1406	Large fiber - no spots Gave a good light it Bent very Little to one side high Vacuum
Aug 12 1407	Large fiber - Broke the Carbon by taking off the pump did not Exhaust
Aug 12 1408	Large fiber - Bad spots Bent as soon as the current was put on gave a bright light sealed off By order Mr Upton

No Lamp	Remarks
Aug 12 1409	Large fiber - Bad spots the carbon Bent out of shape as soon as current was put on gave a Bright light sealed off by order from Mr Upton
Aug 12 1410	Large fiber - Bad spots did not Bend as much as No 1408 and 1409 gave a good Light
Aug 12 1411	Large fiber - Bad spots did not Bend as much as No 1408 and 1409 gave a good Light Was split in the Clamp
1412	
X	

No Lamp	Remarks
Aug 12 1413	Large fibes - Broke the Carbon as soon as the current was put on did not get any Light
Aug 16 1414	Large fibes - Bad spots the Carbon was carrigated gave a good Light Bent out of shape Broke when full current was put on
1415	
Aug 12 1416	Large fibes - Bad spots gave a bright Light did not bend the Carbon did not get a high Vacuum

No Lamp	Remark
Aug 12 1417	Large fiber- did not Exhaust- sealed off by order- from Mr Uptons
Aug 13 1418	Large fiber no spots the carbon was carrigated and gave a good Light did not Bend any high Vacume
Aug 13 1419	Large fiber- same as 1418 Bad spots in the carbon gave a good Light did not Bend the carbon when full Current was on. Very strait high Vacume when sealed off.
Aug 13 1420	Large fiber- Bad spots in Carbon split- in the Clamp. Gave a good Light Bent- very little sealed off with high Vacume

No Lamp	Remarks
Aug 13 1421	Large fibes - Bad spots Gave a good Light - [illegible] very Little sealed off with high Vacuum
Aug 13 1422	Large fibes - Bad spots - Gave a Bright - Light - was sealed off did not get a high Vacuum the Engine Stopped for all night
Aug 13 1423	Large fibes - Bad spots - Gave a Bright - Light - did not get a high Vacuum the Engine stopped for the night - did not have any steam
Aug 14 1424	Large fibes - no spots Gave a good Light - did not have high Vacuum

No Lamp	Remarks
Aug 14 1425	Large fibers - Broke as soon as the Current was put on - did not give any Light
Aug 14 1426	Large fibers - Bad Spots in the carbons and Bent as soon as the Current was put on - did not Exhaust
Aug 14 1427	Large fibers - Bad Spots the carbon was Corrigated gave a good Light the carbon Bent very Little slightly Blue high Vacuum
Aug 14 1428	Large fiber - Bad Spots the Carbon was Corrigated gave a bright Light was Bent a Little to one side high Vacuum

No. Lamp	Remarks
Aug 14 1429	Large fiber- no spots split- in the clamp did not Bend Broke on the pump by the Boy striking the Lamp N.G.
Aug 14 1430	Large fiber- Bad spots in the carbon and did not Exhaust the carbon was no good sealed. off N.G
Aug 16 1431	Large fiber- no spots gave a good Light was split in the clamps slightly Blue high Vacuum did not Bend
Aug 16 1432	Large fiber Bad spots did not give a good Light- it Bent the carbon when current was put on did not get a high Vacuum

1433 Large fibers-
Bad spots split in clamp gave a Bright Light- but it bent over to one side high Vacuum

No Lamp	Remarks
Aug 14 1434	Large fibers- Bad spots gave a Bright Light- Broke on the pump and made a Loud Report same as a Pistol
Aug 16 1435	Large fibers- no spots gave a good Light and did not bend the Carbon When current was on
Aug 17 1436	Large fibers- no spots gave a good Light and did not Bend high Vacuum
Aug 18 1437	Large fibers- Bad spots gave a good Light bent very little high Vacuum

No Lamp	Remarks
Aug 19 1438	Large fiber - Bad spots in the Carbon Close to the Clamp Bent very little but it gave a good light sealed off with Vocuum at 45
Aug 19 1439	Large fiber - no spots gave a good light. did not Bend high Vocuum
Aug 15 1440	~~Small~~ fiber - Bad spots gave a good light could not get a high Vocuum Lamp was on pump 3½ hours
Aug 18 1441	Large fiber Bad spots in Carbon close to the clamp split in clamp gave a Bright light could not get a high Vocuum sealed off

No of Lamp	Remarks
Aug 18 1442	Large fiber - Bad spots gave a good light - did not bend any sealed off with high vacuum
Aug 18 1443	Large fiber - Bad spots gave a good light - was slightly blue did not bend any high vacuum
Aug 19 1444	Large fiber - no spots gave a good light bent very little high vacuum
Aug 18 1445	Large fiber Bad spots gave a good light - did not bend high vacuum

No of Lamp	Remarks
Aug 18 1446	Large fiber - Bad spots Gave a good Light - did not Bend the Carbon any Perfectly strait Very high Vacuum
Aug ~~20~~ 2 1447	[illegible] in glass [illegible] Large fiber - Bad spots very Bad spot at the Clamp and Bent out of shape did not get a high Vacuum Lamp NG
Aug ~~20~~ 20 1448	~~Large fiber [illegible]~~ Large fiber - no spots Gave a good Light - did not Bend any Perfectly strait high Vacuum
Aug 18 1449	Large fiber - Bad spots Gave a good Light - Bent very Bad did not get a high Vacuum

Ord of Lamp	Remarks
Aug 18 1450	Large fiber - Bad spots Gave a good Light - did not Bend any sealed off With high Vacuum
Aug 20 1451	Large fiber - Bad spots gave a good Light split in the Clamp. Bent very Little high Vacuum
Aug 19 1452	Large fiber - Bad spots gave a good Light. Bent very Little sealed off With high Vacuum
Aug 18 1453	Large fiber - 8/1000 X 15/1000 no spots Perfectly strait sealed off high Vacuum By order - TAE

No of Lamp	Remarks
Aug 20 1454	Large fibes- 9/1000 By 15/1000 no spots gave a good Light the Carbon Bent some sealed off good vacuum Taken By McKensie
Aug 19 1455	Large fibes-9/1000 By 15/1000 Bad spots gave a good light Broke on the Pump the inside bulb cracked With a good Vacuum
Aug 20 1456	Large fibes-9/1000 By 15/1000 no spots gave a good light the carbon Bent one clamp got Black had a high Vacuum
Aug 19 1457	Large fibes-8/1000 By 16/1000 no spots gave a good Light did not Bend high Vacuum

No Lamp	Remarks
Aug 20 1458	Large fiber 9/1000 16 x 1000 Bad spots the carbon was carrigated and Bent out of shape could not get a high Vacuum on pump 3 hours split in Clamp
Aug 21 1459	Large fiber 9/1000 By 15/1000 no spots Carbon was [illegible] in the Clamp gave a good light [illegible] with [illegible] Vacuum
Aug 21 1460	Large fiber 9/1000 By 15/1000 no spots gave a good light Bent [illegible] little high Vacuum
Aug 21 1461	Large fiber Put in Carbon Tester Bad spots did not Put in Clamp very Bright spot in Bottom of carbon Time 15 minuts

1463 Was on the Carbon tester before going on the pump and had Light spots

No Lamp	Remarks
Aug [illegible] 1462	[illegible] [illegible] Was on the carbon tester and had bright spots in [illegible] [illegible] it looked almost [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] current [illegible] [illegible] The [illegible] Bad [illegible] slightly [illegible] [illegible] [illegible]
Aug 25 1463	Large fibes - nickel clamps very Light spots gave a good Light when full current was on there was a Blue spots about the clamps Bent very Little
Aug 25 1464	Large fiber nickel clamps Light spots in the carbon gave a good Light Sealed off with high Vacuum did not Bend
Aug 25 1465	Large fiber nickel clamps Carbon was on the carbon tester before going in Lamp no spots gave a good Light was slightly Blue Bent very Little high Vacuum

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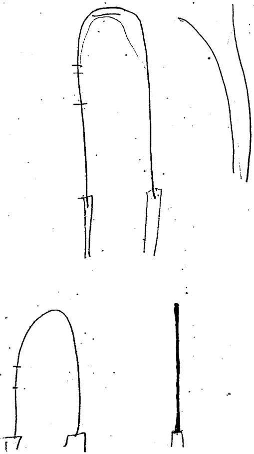

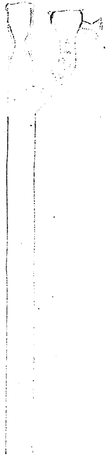

284 Clean finish with Benzine and Poss as through

Geo H Hill
Sunday July 25-1880

AUG 1 OCT 1880

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